TABLETS OF ANATOMY.

BY

THOMAS COOKE, F.R.C.S.

EIGHTH EDITION.

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TABLETS

OF

ANATOMY.

BY

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Being a Synopsis of Demonstrations given in the Westminster Hospital Medical School in the Years 1871, -72, -73, -74, -75.

EIGHTH THOUSAND,

BEING A

SELECTION OF THE TABLETS BELIEVED TO BE MOST USEFUL TO STUDENTS GENERALLY.

> "The schemes of any of the arts or sciences may be analysed in a sort of skeleton, and represented upon tables, with the various dependencies and connections of the several parts and subjects that belong to them; and the frequent review of these abstracts and epitomes would tend much to imprint them on the brain, when they have been once well learned; this would keep those learned traces always open, and assist the weakness of a labouring memory."
>
> ISAAC WATTS, D.D.,
> ON "THE IMPROVEMENT OF THE MIND."

LONGMANS, GREEN, & CO., PATERNOSTER ROW, LONDON.

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PREFACE TO THE EIGHTH THOUSAND.

This Edition has been thoroughly revised and corrected.

Eighteen years' experience in the use of the Tablets of Anatomy has shown that, from the point of view of their utility to Students, the Tablets may be divided into two classes:—

I.—Those—the majority,—which may be considered useful to *most* Students.

II.—Those which are of use mainly to such as are preparing for the *higher examinations*.

The Tablets which may be fairly considered to come within Class I., have alone been introduced into this Edition.

The bulk and price of the work have therefore been considerably reduced.

It has also been thought desirable to group the Tablets according to the several regions of the body, so that the book may become a companion to the several Dissectors' Manuals.

Special facilities have further been provided for the easy division of the book into parts or segments of a convenient size for carrying in the coat pocket. To this effect, the several groups of subjects, Posterior Triangle of the Neck, Anterior Triangle of the Neck, Orbit, etc., have each been arranged in what bookbinders call a "section"; and if the book be opened somewhat forcibly between the *front or title page* of one section, and the *last page* of the preceding section, it will easily be divided at this point by simply cutting the bookbinder's threads or tapes. And each section will be found to contain a complete subject, to form a synopsis, so to speak, of one of the ordinary classes given by the Author in his private Anatomical School, and to constitute a pamphlet which, folded in two, will bear carrying about without falling to pieces. **The advantages of a small book are thus added to some extent to those of a book of ordinary size.** This arrangement has involved, however, some repetitions and a few omissions, the latter generally unimportant, it is believed, and mostly remedied in the Appendix.

The minute Anatomy, which is now generally taken under the head of Physiology, and such subjects as have mainly reference to minute anatomy, such as the ear, the eye, etc., have been removed from this edition.

40, Brunswick Square,
January, 1889.

PREFACE TO THE FIRST EDITION.

In a Learner's point of view Scientific facts may, the Author thinks, be divided into those which are daily met with by the Student, and which soon become familiar to him, and those which are learned with considerable pains and afterwards easily forgotten, and which require to be constantly recalled to the mind.

The Author has endeavoured to deal with the latter class of facts only. What every one knows, who has at all studied Medicine, he has purposely left out. Greater condensation is thus obtained. – To the non-medical reader the Tablets may appear disconnected, and the descriptions they contain (if descriptions they may be called) may seem dry and naked. The Author believes that the Student will easily supply the links, and give life and shape to the skeleton sketches.

This book is intended neither for the idle, nor for absolute beginners. The idle will find that it contains more details than they will care to master, and that its brevity demands more mental application than would be agreeable to any one, whose mind has not been trained to close study.

Beginners, however, who mean to work, may, after attending a lecture, or reading up in one of the Standard Authors a region they have just been dissecting, advantageously revise the subject in the Tablets; and these partial revisions will be found to fix the main points in the mind, and to facilitate the more important revisional effort, which, even the first year's student is usually called upon to make, whenever his lecturer has finished describing a part, or he himself has finished dissecting one.

The more or less advanced Students, who are doing, or have done, their work honestly and conscientiously, are the ones the Author has had mainly in view.

September, 1871.

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BONES OF TRUNK.

THE VERTEBRÆ.

Present for examination: –

Body – Forms a short column, which presents:

ANT. SURFACE – Convex from side to side, concave from above downwards; presents numerous small vascular foramina.

POST. SURFACE – Concave from side to side, flat from above downwards; presents one or more irregular apertures for exit of venæ basis vertebræ.

UPPER & UNDER SURFACES – Rough & slightly concave, and surrounded by a prominent rim.

Pedicles – Join the body to the laminæ. They are constricted, and their constriction gives rise to the

Notches – Which latter, by the superposition of the vertebræ, form the *intervertebral foramina.*

Laminæ – Broad & flat, rough above & below for the ligamenta subflava; bound posteriorly the

Foramen – Which, by the superposition of the vertebræ, forms the spinal canal.

Spinous process – Projects backwards from the point of junction of the laminæ.

Transverse processes – Two. Project outwards from the sides of the arch.

Articular processes – Four. Project upwards & downwards from the point of junction of the pedicles with the laminæ. The superior ones look backwards, the inferior ones look forwards.

N. — But little, which would be applicable to *each* of the three groups of vertebræ, can, it is believed, be added to this description.

THE THREE GROUPS of VERTEBRÆ.

CERVICAL VERTEBRÆ — The smallest. Present: –

BODY — Small, broad from side to side. Presents: –
UPPER SURFACE – Concave from side to side, and rounded off anteriorly.
UNDER SURFACE – Convex from side to side, and prolonged downwards anteriorly.
ANTERIOR SURFACE – Situated therefore on a lower level than the posterior.
PEDICLES — Arise from lower part of body, and of the two
NOTCHES — The superior ones are the deepest, and somewhat the narrowest.
LAMINÆ — Long and narrow.
FORAMEN — Large and triangular.
SPINOUS PROCESS — Projects horizontally backwards, and is short, bifid, & grooved inferiorly.
TRANSVERSE PROCESSES — Short, bifid, grooved superiorly, perforated at their base for passage of vertebral artery & vein, and situated *on the outer side of the pedicles, in front of the articular processes.*
The existence of the foramen at the base of the cervical transverse processes, and the situation of these processes on the outer side of the pedicles, are owing to their being formed of two roots, which roots correspond, the anterior one to the transverse processes properly so-called, the anterior one to the ribs.
ARTICULAR PROCESSES — Form a small vertical column. The superior ones look upwards & backwards, the inferior ones look downwards & forwards.

DORSAL VERTEBRÆ — Intermediate in size. Present: –

BODY — Heart-shaped, thicker behind than in front, and has two demi-facets on each side, which facets articulate with the heads of the ribs.
PEDICLES — Arise from upper part of body, and of the two
NOTCHES — The inferior ones are the deepest and broadest.
LAMINÆ — Short & broad.
FORAMEN — Small & round.
SPINOUS PROCESS — Long, triangular, oblique, and ends in a single tubercle.
TRANSVERSE PROCESSES — Long, thick, obliquely directed outwards & backwards, and situated *behind the articular processes & the pedicles.* Their extremity is enlarged, and presents in front an articular facet for tubercle of corresponding rib.
From the back of the extremity of the few lower dorsal transverse processes arise three tubercles, termed *external, inferior, & superior,* which tubercles correspond respectively to the transverse processes of the lumbar vertebræ, and to the accessory & mammillary tubercles found, the former on the back of the transverse processes, the latter on the back of the superior articular processes of the lumbar vertebræ.
ARTICULAR PROCESSES — Nearly vertical. The superior ones look backwards & outwards, the inferior ones look forwards & inwards.

LUMBAR VERTEBRÆ — The largest. Present: –

BODY — Large, broadest from side to side, rather thicker in front than behind.
PEDICLES — Thick; arise from upper part of body, and of the two
NOTCHES — The inferior ones are the deepest & broadest.
LAMINÆ — Short, broad & thick.
FORAMEN — Triangular, larger than in the dorsal region, smaller than in the cervical.
SPINOUS PROCESS — Thick, quadrilateral, and ends in a rough vertical border.
TRANSVERSE PROCESSES — Long, slender, directed transversely outwards, and situated *in front of the articular processes, but behind the pedicles,* and in a line with the external tubercles of the lower dorsal transverse processes, to which they correspond.
On the back of each, near its base, is a small tubercle the *accessory tubercle,* which points downwards & inwards, and which corresponds to the inferior tubercles on the lower dorsal transverse processes.
ARTICULAR PROCESSES — Thick, strong & vertical. The superior ones are concave, look backwards & inwards, and are farther apart than the inferior ones, which they embrace. The inferior ones are convex, look forwards & outwards, and are nearer to each other than are the superior ones.
On the back of each superior articular process is a small tubercle, the *mammillary tubercle,* which corresponds to the superior tubercles on the lower dorsal transverse processes.

THE THREE GROUPS COMPARED SERIATIM.

Body – CERVICAL – Small, broad from side to side. Presents: –
Upper Surface – Concave from side to side, & rounded off anteriorly.
Under Surface – Convex from side to side, & prolonged downwards anteriorly.
Anterior Surface – Situated therefore on a lower level than the posterior.
DORSAL – Heart-shaped, thicker behind than in front, and has two demi-facets on each side which demi-facets articulate with the heads of the ribs.
LUMBAR – Large, broadest from side to side, rather thicker in front than behind.

Pedicles – CERVICAL – Arise from lower part of body.
DORSAL –Arise from upper part of body.
LUMBAR – Thick; arise from upper part of body.

Notches – CERVICAL – The superior ones are the deepest, and somewhat the narrowest.
DORSAL – The inferior ones are the deepest and broadest.
LUMBAR – The inferior ones are the deepest & broadest.

Laminæ – CERVICAL – Long & narrow.
DORSAL – Short & broad.
LUMBAR – Short, broad & thick.

Foramen CERVICAL – Large & triangular.
DORSAL – Small & round.
LUMBAR – Triangular, larger than in the dorsal, smaller than in the cervical.

Spinous Process —
CERVICAL – Projects horizontally backwards, and is short, bifid, & grooved inferiorly.
DORSAL – Long, triangular, oblique, and ends in a single tubercle.
LUMBAR – Thick, quadrilateral, and ends in a rough vertical border.

Transverse Processes —
CERVICAL – Short, bifid, grooved superiorly, perforated at their base for passage of vertebral artery & vein, and situated *on the outer side of the pedicles, in front of the articular processes.*
DORSAL – Long, thick, obliquely directed outwards & backwards, and situated *behind the articular processes & the pedicles.* Their extremity is enlarged, and presents in front an articular facet for tubercle of corresponding rib.
From the back of the extremity of the few lower dorsal transverse processes arise three tubercles, termed *external, inferior, & superior,* which tubercles correspond respectively to the transverse processes of the lumbar vertebræ, and to the accessory & mammillary tubercles found, the former on the back of the transverse processes, the latter on the back of the superior articular processes of the lumbar vertebræ.
LUMBAR – Long, slender, directed transversely outwards, and situated *in front of the articular processes, but behind the pedicles,* and in a line with the external tubercles of the lower dorsal transverse processes, to which they correspond.
On the back of each, near its base, is a small tubercle the *accessory tubercle,* which points downwards & inwards, and which corresponds to the inferior tubercles on the lower dorsal transverse processes.

Articular Processes –
CERVICAL – Form a small vertical column. The superior ones look upwards & backwards, the inferior ones look downwards & forwards.
DORSAL – Nearly vertical. The superior ones look backwards & outwards, the inferior ones look forwards & inwards.
LUMBAR – Thick, strong & vertical. The superior ones are concave, look backwards & inwards, and are farther apart than the inferior ones, which they embrace. The inferior ones are convex, look forwards & outwards, and are nearer to each other than are the superior ones.
On the back of each superior lumbar articular process is a small tubercle, the *mammillary tubercle,* which corresponds to the superior tubercles on the lower dorsal transverse processes.

PECULIAR VERTEBRÆ.

Are the:

Atlas } Vide following Tablet.
Axis }

7th Cervical Vertebra, or Vertebra Prominens

Spinous process thick, long, prominent, nealy horizontal; ends in a single tubercle for ligamentum nuchæ.

Transverse process large, but slightly grooved, seldom bifid. Its foramen is usually small, sometimes wanting, and seldom gives passage to both artery & vein.

1st Dorsal Vertebra

Body broad from side to side and lipped superiorly & behind; presents a complete facet above for head of 1st rib, and a demi-facet below for upper facet on head of 2nd rib.

Spinous process thick & but slightly inclined.

Articular processes somewhat oblique, as in the cervical vertebræ.

9th Dorsal Vertebra

Usually no inferior demi-facet.

10th Dorsal Vertebra

But one costal facet (the superior), which is usually complete.

11th Dorsal Vertebra

But one costal facet, which is always complete.

Transverse processes short, and without articular facets.

12th Dorsal Vertebra

But one costal facet, which is always complete.

Transverse processes short, and without articular facets.

Inferior articular facets, convex and looking forwards & outwards like those of lumbar vertebræ.

5th Lumbar Vertebra

Body much thicker in front than behind.

Spinous process small.

Inferior articular processes, farther apart than superior.

Transverse processes, large, thick, slightly inclined upwards.

ATLAS & AXIS.

THE ATLAS

Presents anterior & posterior arches, foramen, and lateral masses.

ANTERIOR ARCH — Presents:

ANTERIOR SURF. – Convex, in centre of which is a *tubercle* for superior oblique portion of longus colli, and for superficial anterior occipito-atloid & superficial anterior atlo-axoid ligaments.

POSTERIOR SURF. – Concave, in centre of which is an *oval facet*, which articulates with odontoid process of axis.

UPPER & LOWER BORDERS – For deep anterior occipito-atloid & deep anterior atlo-axoid ligaments.

POSTERIOR ARCH — Presents just behind the lateral masses the *Grooves* representing the *superior & inferior intervertebral notches.* – The superior grooves, which are the deepest and are sometimes converted into complete foramina, transmit the vertebral artery & the suboccipital nerve.

The posterior arch then becomes rounded, and is rough above & below for the posterior occipito-atloid & posterior atlo-axoid ligaments. It ends posteriorly in a *tubercle* for rectus capitis posticus minor.

FORAMEN — Large, and divided by transverse ligament (transverse portion of crucial ligament) into a posterior part, the largest, for spinal cord & its membranes, and an anterior part, the smallest, which receives the odontoid process of the axis.

LATERAL MASSES — Short & thick columns of bone, which present internally, externally, above & below, a *tubercle* for the transverse ligament;

Transverse Process – Large, not bifid nor grooved superiorly, perforated at its base by a very large foramen;

Sup. Articular Surf. – Large, oval, concave, converging towards its fellow anteriorly, and looking upwards, inwards & slightly backwards.

Inf. Articular Surf. – Rather smaller, flat, circular, and looking downwards & inwards.

THE AXIS

Presents the following peculiarities

Body – A good deal thicker in front than behind. It presents anteriorly a *median ridge & two lateral depressions* for part of internal or vertical portion of longus colli, and is surmounted by the

ODONTOID PROCESS – Tooth-like, presenting:

Apex – For median or suspensory occipito-odontoid ligament, and, laterally, for lateral occipito-odontoid, or check ligaments.

Body – Articular in front & behind for anterior arch of atlas & transverse ligament.

Neck – Constricted, and bound down by transverse ligament.

Pedicles – Strong & thick, lie beneath the superior articular surface, and are but very slightly grooved superiorly.

Notches – The superior are very shallow, and lie behind the superior articular surfaces: the inferior ones are much deeper and lie in front of the corresponding articular surfaces.

Laminæ – Thick & strong.

Foramen – Large, but smaller than that of atlas.

Spinous Process – Thick, bifid, deeply grooved inferiorly.

Transverse Processes – Small, pointed; foramen oblique upwards & outwards.

Articular Surfaces:

Superior – Rest upon the body, pedicles & transverse processes in front of the notches, and are large, flat, circular, and look upwards & outwards.

Inferior – Smaller, look downwards & forwards, and are similar to those of the other cervical vertebræ

THE RIBS.

Twelve.

Seven Sternal or True – Connected to the sternum by their costal cartilages; these increase in length from above downwards.

Five False or Asternal – Of which the three first are connected by their cartilages to the cartilage of the rib above, while the two last, or *floating ribs*, are entirely disconnected in front. The asternal or false ribs decrease in length from above downwards.

The *breadth* of the ribs decreases from the 1st to the last; so does also the width of the corresponding intercostal spaces.

The *degree of obliquity* of the ribs increases from the 1st to the 9th, and decreases from the 9th to the 12th. It is most marked between the head & the posterior angle.

The ribs are both *curved* & *twisted* upon themselves. The curve of the ribs is most marked in the neighbourhood of the posterior angle. The twist is such that the outer surface of the shaft looks slightly downwards behind & slightly upwards in front, and that, if the lower border of the shaft be placed upon a flat horizontal surface from the anterior extremity of the bone to the posterior angle, the part of the bone behind the angle, will be found to pass upwards & inwards.

COMMON CHARACTERS — A rib presents two extremities & a shaft.

POSTERIOR EXTREMITY — Presents head, neck & tuberosity.

HEAD – Presents:

two oblique facets, a small superior one & a larger inferior one, which facets articulate with the bodies of two adjoining vertebræ, and are separated by a

horizontal ridge, to which the interarticular ligament is attached.

NECK – Flattened from before backwards, about an inch in length; presents:

Anterior Surf. – Smooth, continuous with inner surface of the shaft.

Posterior Surf. – Rough for interosseous costo-transverse ligament.

Upper Border – Has a rough crest, for superior costo-transverse ligament.

Lower Border – More or less rounded.

TUBEROSITY – Most prominent in the upper ribs. Presents:

Inferior Internal, or Articular Portion – Has a facet for the extremity of the tranverse process of the inferior of the two vertebræ with which the head is connected.

Superior External, or Non-articular Portion – Rough for external costo-transverse ligament.

SHAFT — Thin & flat. Presents:

OUTER SURFACE – Convex, on which is found posteriorly the

Angle, or Posterior Angle – A rough line oblique downwards & forwards, which gives attachment to the tendons of the sacro-lumbalis, its accessory muscle, & the cervicalis ascendens, and which separates a

posterior rounded portion, giving attachment to the longissimus dorsi, and increasing in length from the 2nd rib to the 10th, and an

anterior flattened portion, smooth, looking slightly downwards behind & slightly upwards in front, which presents anteriorly the

Anterior Angle – Similar to the posterior but more faintly marked.

INNER SURFACE – Concave, looks slightly upwards behind & slightly downwards in front, and presents inferiorly a

ridge extending over the posterior two-thirds of the shaft, & most marked behind, which ridge gives attachment to the internal intercostal muscles, and forms the inner boundary of the

Groove – For the intercostal vessels & nerves, which groove is deepest & most marked just in front of the angle.

UPPER BORDER – Rounded; gives attachment to both internal & external intercostal muscles.

LOWER BORDER – Thin & sharp. Forms outer boundary, of foregoing groove, and gives attachment to corresponding external intercostal muscle.

ANTERIOR EXTREMITY — Compressed from before backwards, presents a

deep oval pit, studded with vascular foramina into which pit the corresponding costal cartilage is received.

PECULIAR RIBS.

Are the:

First Rib – Broad, flat, horizontal, the most curved, and usually the shortest. Its
SURFACES – Look upwards & downwards.
Upper Surface – Presents posteriorly a
rough impression for scalenus medius, and anteriorly a slightly marked *tubercle* most prominent internally, for scalenus anticus, which tubercle separates
two shallow grooves, the anterior one for the subclavian vein, the posterior one for the subclavian artery.
Under Surface – Has no ridge nor groove.
BORDERS – Are turned inwards & outwards.
Inner Border – Concave, thin; presents inner part of tubercle for scalenus anticus.
Outer Border – Convex & rounded.
HEAD – Small, rounded, with a single facet for 1st dorsal vertebra.
NECK – Short & rounded.
TUBEROSITY – Large, prominent, situated on outer border.
ANGLE – Blended with tuberosity.
ANTERIOR EXTREMITY – Large & thick.

Second Rib – Is longer, less curved, only slightly oblique, and scarcely twisted.
SURFACES – Look slightly outwards & inwards.
Outer or Upper Surface – Rough & prominent towards its middle for second & third digitations of serratus magnus; rough posteriorly for scalenus posticus.
Inner or Under Surface – Has but a short & slightly marked groove.
TUBEROSITY & ANGLE – Close together; the latter slightly marked.

Tenth Rib
HEAD – Has usually but a single articular facet.

Eleventh Rib
HEAD – But a single articular facet.
No NECK.
No TUBEROSITY.

Twelth Rib
HEAD – But a single anterior facet.
No NECK.
No TUBEROSITY.
No ANGLE.
No GROOVE.
The two last ribs are but slightly curved, and are short & pointed, the twelfth rib being sometimes the shortest of all.

BONES OF SKULL.

THE FRONTAL BONE.

Articulates with sphenoid & ethmoid, and with both parietal, nasal, superior maxillary, lachrymal & malar.

Divided into vertical or frontal, and horizontal or orbito-nasal portions.

VERTICAL OR FRONTAL PORTION — Presents:

Ext. Surface – Presents in median line:

Median suture, usually obliterated a few years after birth, and below which is the *Nasal eminence;* – and laterally from above downwards:

Frontal eminence;

Superciliary ridge caused by projection of frontal sinuses, broad inwardly where it joins the nasal eminence;

Supraorbital arch, presenting at its inner third the

Supraorbital notch or foramen, for supraorbital vessels & nerve, – and which arch terminates externally and internally in the external & internal angular processes.

EXT. ANGULAR PROCESS – Thick & strong; articulates with malar bone, and presents externally a part of the

Temporal ridge.

INT. ANGULAR PROCESS – Thinner; articulates with lachrymal bone, and bounds the

Nasal notch, which articulates with nasal bones & nasal processes of superior maxilla, and presents below the

Nasal spine.

Int. Surface – Concave. Presents in median line and from below upwards:

Foramen cæcum (completed behind by ethmoid) for small vein to longitudinal sinus and a process of falx cerebri;

Frontal crest, which is continued into

Groove for longitudinal sinus & falx cerebri; – and laterally

Cerebral impressions and

Grooves for branches of anterior & middle meningeal arteries.

HORIZONTAL OR ORBITO-NASAL PORTION — Consists of the two orbital plates separated by the ethmoidal notch.

ORBITAL PLATES — Present:

Under Surface – Concave, on which are seen externally the

Lachrymal fossa for lachrymal gland, and internally the

Fovea trochlearis for pulley of superior oblique.

Upper Surface – Convex, forms part of anterior fossa of base of skull, and presents well marked cerebral impressions.

ETHMOIDAL NOTCH – Is filled up by horizontal plate of ethmoid. – The under surface of its margin presents:

Several half-cells, which complete & close the ethmoidal cells, and

Two grooves, which form part of

Anterior ethmoidal canal for nasal n. & ant. ethmoidal vessels, and of

Posterior ethmoidal canal for posterior ethmoidal vessels.

In front of the ethmoidal notch is the

Nasal spine, which articulates with nasal bones & perpendicular plate of the ethmoid and forms part of roof of nose, and on the sides of which are the

Openings of the frontal sinuses

The circumference of the bone is thick in the vertical or frontal portion, where it is serrated for articulation with the parietals, and is bevelled at the expense of the inner table, above, of the outer table, below. In the horizontal portion the circumference is thin & serrated for articulation with the lesser wing of the sphenoid. At the junction of the two portions of the bone the circumference presents a large triangular rough surface for articulation with the greater wing of the sphenoid.

THE OCCIPITAL BONE.

Articulates with parietals, mastoid & petrous portions of temporals, sphenoid & atlas, and presents:

OUTER SURFACE — Convex. Presents from behind forwards:

Ext. occipital protuberance for ligamentum nuchæ;
Ext. occipital crest, from which are given off laterally the
Sup. curved line, for trapezius, sterno-mastoid & occipito-frontalis; and the
Inf. curved line for recti capitis postici major & minor which are also inserted into depression below. – Between the two curved lines are inserted the complexus, splenius & superior oblique.
Foramen magnum for cord and its membranes, spinal accessory nerves & vertebral arteries, on outer side of which foramen are the
Condyles, oblong, converging in front, convex from before backwards, looking downwards & outwards; rough inwardly for attachment of check ligaments, and having in front
Ant. condyloid foramen for hypoglossal nerve; having behind
Post. condyloid fossa sometimes perforated by posterior condyloid foramen for a small vein to lateral sinus, and having on their outer side the
Jugular process for rectus capitis lateralis & lateral occipito-atloid ligament;
Basilar process presenting in middle line the
Pharyngeal spine for tendinous raphe & superior constrictor of pharynx, and laterally a
Rough depression for recti capitis antici major & minor.

INNER SURFACE — Concave, presents from behind forwards:

Crucial ridge, to centre of which corresponds the torcular Herophili, and of which the
Upper division ascends to superior angle, and is deeply grooved for superior longitudinal sinus & falx cerebri;
Inf. division, or int. occipital crest, descends to foramen magnum where it bifurcates; gives attachment to falx cerebelli.
Lateral divisions bound posteriorly the inferior occipital fossæ, and are deeply grooved for lateral sinuses & tentorium cerebelli;
Foramen magnum, near side of which are the
Ant. condyloid foramina & sometimes the
Post. condyloid foramina.
Basilar groove, which supports medulla oblongata & pons, and on each side of which is a half
Groove for inferior petrosal sinus.

BORDERS — Four:

Superior – Form lambdoid suture by articulating with parietals.
Inferior – Articulate with mastoid & petrous portions of temporal, and assist in forming jugular foramen or foramen lacerum posterius.

ANGLES — Four:

Superior – Received between the two parietal bones, and corresponds to posterior fontanelle.
Inferior – Joins with body of sphenoid about 18th or 20th year.
Lateral – Received between posterior inferior angle of parietal and mastoid portion of temporal; presents on its inner surface outer end of groove for lateral sinus.

THE TEMPORAL BONE.

Is situated at side of base of skull, and articulates with *parietal, occipital, sphenoid, malar & inferior maxillary bones.*

Is divided into squamous, mastoid & petrous portions.

SQUAMOUS PORTION — Presents outer & inner surfaces and circumference.

Outer Surface — Convex, forms part of temporal fossa and presents lower part of *temporal ridge* behind, *zygomatic process* in front, and *glenoid fossa* below.

ZYGOMATIC PROCESS — First projects outwards, and is broad & flattened from above downwards. It then twists forwards and presents:

BORDERS – *upper* long & thin for temporal f.; *lower* short & thick for masseter.

SURFACES – *outer* convex, *inner* concave also for masseter.

APEX – Serrated, articulates with malar bone.

BASE – Presents *three roots:*

Anterior – Wide & transversely directed forming *eminentia articularis;*

Middle – Forms posterior boundary of glenoid fossa;

Posterior – Forms origin of temporal ridge.

GLENOID FOSSA — Is comprised between anterior & middle roots of the zygoma, and presents the

GLASERIAN FISSURE – For processus gracilis of malleus, laxator tympani m., & tympanic artery, and divides the fossa into

Anterior part – Articular, and covered with cartilage which is prolonged over the eminentia articularis.

Posterior part – Non-articular, bounded behind by vaginal & auditory processes & middle root of zygoma.

Inner Surface — Concave. Presents cerebral impressions, and grooves for middle meningeal artery.

Circumference — Thin above and behind, where it is bevelled internally and articulates with parietal; thick in front, where it is slightly bevelled externally and articulates with great wing of sphenoid.

MASTOID PORTION — Presents outer & inner surfaces and borders.

Outer Surface — Rough; presents:

Mastoid foramen for a vein to lateral sinus, and is prolonged into

Mastoid process for insertion of sterno-mastoid, splenius capitis & trachelo-mastoid, and on the inner side of which is the

Digastric groove for origin of posterior belly of digastric, and further inwards the

Occipital groove for occipital artery.

Inner Surface — Forms part of posterior fossa of base of skull and presents descending portion of

Groove for lateral sinus.

Borders - Post. & Sup. — Thick & serrated for posterior inferior angle of parietal and lower border of occipital.

PETROUS PORTION — Vide next Tablet.

PETROUS PORTION of the TEMPORAL BONE.

Pyramidal, directed forwards & inwards and wedged in between the sphenoid & the basilar process of the occipital. Presents:

Base — Its exposed part presents the
Meatus auditorius externus, the lower part of which is surrounded by the
Auditory process, to which is attached the cartilage of the pinna.

Apex — Presents the
Internal orifice of the carotid canal; and forms the posterior & outer boundaries of the foramen lacerum medium.

Ant. Surface — Forms posterior boundary of middle fossa of base of skull, and presents from before backwards & outwards the:
Internal orifice of the carotid canal,
Depression for Gasserian ganglion,
Hiatus Fallopii with *a groove leading to it,* both for large superficial petrosal nerve and petrosal branch of middle meningeal artery, and near which hiatus are frequently seen
Two or three other small foramina for small superficial petrosal nerve, petrosal branch of glosso-pharyngeal & branch of glosso-pharyngeal to large superficial petrosal nerve.
Eminence corresponding to the superior semi-circular canal, on the outer side of which is a
Depression corresponding to the cavity of the tympanum.

Post. Surface — Forms anterior boundary of posterior fossa of base of skull, and presents:
Meatus auditorius internus for facial nerve and auditory artery & nerve;
Opening of Aqueductus Vestibuli for small artery & vein to vestibule & a process of the dura mater.

Inf. or Basilar Surface — Presents in a diagonal line from before backwards & outwards:
Rough surface for origin of levator palati & tensor tympani;
Inferior orifice of carotid canal;
Vaginal process which embraces root of
Styloid process, which gives attachment from above downwards to the stylo-pharyngeus, -hyoideus & -glossus muscles, and to the stylo-hyoid & -maxillary ligts.,
Stylo-mastoid foramen for facial nerve & stylo-mastoid artery. – Behind & on inner side of the carotid canal & vaginal process are the
Jugular surface, which articulates with jugular process of occipital, and the
Jugular fossa for sinus of internal jugular vein, which fossa assists in forming jugular foramen or foramen lacerum posterius, and has near to it:
Opening for Arnold's nerve, on its outer wall,
Opening for Jacobson's nerve, in front, on bony ridge between it & carotid canal,
Opening of Aqueductus Cochleæ, in front & to inner side, close to posterior border of the petrous bone.

Borders — Three:
SUPERIOR – Grooved for superior petrosal sinus & attachment of tentorium cerebelli.
POSTERIOR – Grooved in front for inferior petrosal sinus; presents jugular fossa behind.
ANTERIOR – Its INNER PART articulates with spine of sphenoid; its OUTER PART is joined by a suture to the squamous portion of the bone. In the angle of junction of these two portions are found the
Canal for the tensor tympani muscle above, and the
Osseous portion of the Eustachian tube below, on the outer side of which latter opening is the *Canal of Huguier* for exit of chorda tympani.

THE SPHENOID BONE.

Is situated at front part of base of skull, and articulates with the 7 other cranial bones & with vomer & both malar & palate bones.

Presents for examination:

BODY — Is cuboid, but presents only four free surfaces, the two lateral surfaces being continuous with the wings & pterygoid processes.

UPPER SURFACE — Presents from before backwards:
Ethmoidal spine, which articulates with ethmoid;
Smooth surface slightly elevated in median line, and which supports olfactory nerves;
Optic groove leading laterally to optic foramen;
Olivary process;
Pituitary fossa or sella turcica bounded laterally & in front by middle clinoid processes;
Dorsum sellæ notched laterally for 6th pair of cranial nerves, and presenting posterior clinoid processes at its superior angles. On each side of body is the
Cavernous groove curved like an italic *S* for internal carotid artery.

ANTERIOR SURFACE — Presents in middle line the
Sphenoidal crest, which articulates with perpendicular plate of ethmoid; on either side the
Openings of the sphenoidal sinuses, which are partly closed in front by the
Sphenoidal turbinated bones or bones of Bertin. – This surf. articulates laterally with os planum of ethmoid, and inferiorly with orbital process of palate bone.

UNDER SURFACE — Presents in middle line the
Rostrum, which is received between the alæ of the vomer, and is continuous anteriorly with sphenoidal crest; on each side of the rostrum is the
Vaginal process, which passes inwards beneath, and articulates with, the alæ of the vomer, and externally to which is the
Pterygo-palatine groove, which forms pterygo-palatine canal with sphenoidal process of palate bone.

POSTERIOR SURFACE — Articulates with basilar process of occipital bone, with which it unites at age of 18 or 20.

GREATER WINGS — Present:

SUPERIOR or CEREBRAL SURFACE — Forms part of middle fossa of base of skull, and presents from before backwards at its inner part:
Foramen rotundum for superior maxillary nerve;
Foramen ovale for inferior maxillary & small petrosal nerves & small meningeal artery, on the inner side of which latter foramen is sometimes seen the
Foramen Vesalii for a small vein;
Foramen spinosum for middle meningeal artery.

EXTERNAL SURFACE — Is divided by pterygoid ridge into:
Superior part, which enters into formation of temporal fossa, and
Inferior part, which assists in forming zygomatic fossa, and presents posteriorly
Spine of sphenoid for internal lateral ligament of jaw & laxator tympani muscle.

ANTERIOR or ORBITAL SURFACE — Quadrilateral; assists in forming outer wall of orbit and sphenoidal & spheno-maxillary fissures, and articulates with frontal & malar bones. Presents a small spine for lower head of external rectus.

CIRCUMFERENCE.
From Back of Body to Spine – Forms anterior or outer margin of foramen lacerum medium, in front, and articulates, behind, with petrous portion of temporal b.
From Spine to Tip – Articulates with squamous portion of temporal bone, being bevelled internally below, externally above.
From Tip to Front of Body – Presents externally a broad triangular surface for frontal bone, and forms, internally, lower boundary of sphenoidal fissure.

LESSER WINGS or PROCESSES of INGRASSIAS — Long, thin, triangular:

UPPER SURFACE — Smooth, forms part of anterior fossa of base of skull;

UNDER SURFACE — Forms back of roof of orbit and upper boundary of sphenoidal fissure, which latter is bounded internally by body of sphenoid, and transmits 3rd, 4th & 6th nerves, and ophthalmic nerve & vein.

ANTERIOR BORDER — Articulates with frontal bone;

POSTERIOR BORDER — Forms at its inner extremity the anterior clinoid process.

INNER EXTREMITY — Presents two roots which bound optic foramen.

PTERYGOID PROCESS — Consists of two plates which bound pterygoid fossa, and are separated below by a triangular notch filled up by pterygoid process of palate bone. – Its

ANTERIOR SURFACE — Forms posterior wall of spheno-maxillary fossa, and presents anterior orifice of vidian canal.

EXTERNAL PTERYGOID PLATE — Broad, thin, inclined outwards. Forms inner & outer walls of zygomatic & pterygoid fossæ respectively, and gives attachment to internal & external pterygoid muscles.

INTERNAL PTERYGOID PLATE — Narrower & longer. Its
Outer & inner surfaces – Form respectively inner boundary of pterygoid fossa & outer boundary of posterior nares. At its apex it presents
Hamular process for reflection of tendon of tensor palati. and at its base
Scaphoid fossa for origin of that muscle.

THE ETHMOID BONE.

Light, spongy, cuboid, projects downwards from between orbital plates of frontal, and enters into formation of orbits & nasal fossæ.

Articulates with *frontal, sphenoid & sphenoidal turbinated bones, both nasal, superior maxillary, lachrymal, palate, inferior turbinated & vomer.*

May be divided into three parts :

HORIZONTAL OR CRIBRIFORM PLATE — Received into ethmoidal notch of frontal.

Forms part of roof of nose & of anterior fossa of base of skull, and presents in the median line the

Crista galli, which gives attachment to falx cerebri, and articulates below & in front with frontal bone, completing foramen cœcum; – and on each side *Three rows of foramina* for branches of the olfactory nerve, and more anteriorly a *Fissure* for nasal branch of ophthalmic nerve.

PERPENDICULAR PLATE — Descends from under surface of former, and assists in forming nasal septum.

Is more or less inclined to one or other side, and presents numerous grooves for branches of olfactory nerve.

Articulates in front with frontal spine and nasal bones, behind with crest of sphenoid & vomer, and joins below with triangular cartilage of nose.

LATERAL MASSES — Cuboid, and enclose a number of irregular cavities, the ethmoid cells, which are divided into an anterior & a posterior set. Their

Anterior, Upper & Posterior Surfaces – Present numerous half-cells, which are completed respectively by articulation with

Lachrymal bones & nasal processes of superior maxilla,
Frontal bone,
Sphenoidal turbinated bones & orbital processes of palate bones. – The upper surface also presents two grooves which assist in forming the anterior & posterior ethmoidal foramina.

Outer Surface – Presents a thin smooth plate of bone the *os planum* which forms inner wall of orbit, and articulates with :

Lachrymal bone, in front ;
Orbital plate of frontal, above ;
Body of sphenoid, behind ;
Superior maxillary & orbital process of palate bone, below.

Under Surface – Presents under surface of middle turbinated process and the projecting *Unciform process*, which articulates with inferior turbinated bone, and assists in forming inner wall of the antrum of Highmore.

Inner Surface – Forms part of outer wall of nasal fossæ, and presents from above downwards the

Superior turbinated process, small and corresponding to post. part of nasal fossæ ;
Superior meatus, which communicates with posterior ethmoidal cells ;
Middle turbinated process, which extends along whole length of lateral mass ;
Middle meatus, which communicates with the anterior ethmoidal cells (and through these with the frontal sinus) by means of a wide funnel-shaped canal, the *Infundibulum*.

THE PARIETAL BONE.

OUTER SURFACE — Convex, and presents:
Parietal foramen at upper & back part;
Parietal eminence;
Temporal ridge, below which it forms part of temporal fossa.

INNER SURFACE — Concave, and presents:
Cerebral eminences & depressions;
Furrows, for ramifications of middle meningeal artery;
Half-groove for superior longitudinal sinus & falx cerebri;
Depressions for Pacchionian bodies.

BORDERS — Four:

Superior – Form sagittal suture by articulating with each other;

Inferior – Are:

In Front – Bevelled externally & overlapped by great wing of sphenoid & squamous portion of temporal;

Behind – Serrated for articulation with mastoid portion of temporal.

Anterior – Serrated, and form coronal suture by articulating with frontal.

Posterior – Serrated, and form lambdoid suture by articulating with occipital.

ANGLES — Four:

Anterior Superior & Posterior Superior – Correspond to anterior & posterior fontanelles, and form part of foregoing sutures.

Anterior Inferior – Received between frontal & great wing of sphenoid, an inch above and behind superior external angle of orbit. – Is grooved internally and sometimes chanelled for anterior branch of middle meningeal artery.

Posterior Inferior – Articulates with mastoid portion of temporal, and presents part of groove for lateral sinus.

BONES OF FACE.

SUPERIOR MAXILLARY BONE—1st Tablet.

Forms the whole of upper jaw by its union with its fellow.
Assists in forming:
Roof of mouth, floor & outer wall of nose, floor of orbit ;
Zygomatic & spheno-maxillary fossæ ;
Spheno-maxillary & pterygo-maxillary fissures.
May be described as presenting a body and four processes, malar, nasal, alveolar & palate.

BODY — Hollowed out to form Antrum of Highmore. – Presents:

OUTER SURFACE — Convex. Presents from within outwards & backwards:
Incisive or myrtiform fossa for depressor alæ nasi,
Canine fossa, large & deep for origin of levator anguli oris & compressor nasi; at upper part of which fossa is the
Infra-orbital foramen for infra-orbital vessels & nerve;
Vertical ridge, which descends from malar process, and behind which is the
Maxillary tuberosity, which is rough along its posterior border for articulation with the palate bone & sometimes with pterygoid process of sphenoid.

INNER SURFACE — Divided into two unequal parts by palate process.
PART ABOVE PALATE PROCESS – Presents from before backwards the
Inferior turbinated crest, above and below which are
Two wide antero-posterior grooves, which form part of middle & inferior meatuses, and the former of which is surmounted by the
Superior turbinated crest, which lies on inner surface of nasal process;
A deep groove which is converted into nasal duct by articulation with lachrymal & inferior turbinated bones ;
Aperture of Antrum of Highmore very large in disarticulated bone but diminished in articulated skull by ethmoid, lachrymal, inferior turbinated & palate bones, and presenting inferiorly a fissure into which is received the maxillary process of the palate bone.
A rough surface which articulates with palate bone and is divided into an anterior & a posterior portion by a
Vertical groove, which forms part of posterior palatine canal.
PART BELOW PALATE PROCESS – Forms anterior part of roof of mouth.

UPPER SURFACE — Forms greater part of floor of orbit, and is bounded:
On Inner Side – By a thin edge which articulates from before backwards with lachrymal bone, os planum & orbital process of palate bone.
On Outer Side – By a rounded margin which forms part of spheno-maxillary fissure.
in Front – By lower part of circumference of orbit. – It presents behind
Infra-orbital groove for infra-orbital vessels & nerve, which groove becomes converted in front into
Infra-orbital canal ; – and at its anterior & inner part a
Depression for inferior oblique muscle.

Antrum of Highmore or Maxillary Sinus – Is a large cavity hollowed out of body of the superior maxillary bone.
Its walls correspond to the three surfaces of the body of the bone; they are very thin, and contain the infra-orbital & ant. & post. dental canals.
Its aperture communicates with the middle meatus of the nasal fossæ, and is much diminished in size, and generally divided into two by articulation with ethmoid, lachrymal, inferior turbinated & palate bones.
Several laminæ of bone project into its cavity, as do also the roots of the 1st & 2nd molar teeth, which sometimes perforate its floor.

SUPERIOR MAXILLARY BONE—2nd Tablet.

MALAR PROCESS — Triangular, and presents:

Ant. Surface – Concave, forms part of canine fossa;
Post. Surface – Concave, forms part of zygomatic fossa;
Sup. Surface – Rough for articulation with malar bone.

NASAL PROCESS — Triangular, and presents:

Outer Surface – Concave, gives attachment to orbicularis palpebrarum, tendo oculi, levator labii superioris alæque nasi.

Inner Surface – Presents from above downwards:
Rough surface, which articulates with ethmoid bone;
Superior turbinated crest which articulates with middle turbinated bone;
Inferior turbinated crest with the two grooves already described.

Ant. Border – Thin, serrated above for articulation with nasal bone, and continuous below with margin of the deep notch, which bounds laterally the anterior aperture of the nasal fossæ.

Post. Border – Presents a groove which forms part of nasal duct, of which groove the
Inner margin articulates with lachrymal bone, while the
Outer margin forms part of circumference of orbit, and presents the
Lachrymal tubercle at its junction with orbital surface.

ALVEOLAR PROCESS — Forms a curve of a semi-horse-shoe shape. Is thicker behind than in front, and presents eight alveoli in adults, five in children.

PALATE PROCESS — Presents:

Upper Surface – Concave from side to side. Forms part of floor of nasal fossa, and presents in front the
Incisor foramen or *foramen of Stenson*, which is completed on its inner side by a thin lamina of bone directed backwards from its anterior to its posterior border (from the latter of which this lamina remains disconnected in youth). This foramen leads below into the
Anterior palatine canal formed by the junction of the two bones, into which canal when it is viewed from below, are also seen to open two other small foramina, the
Foramina of Scarpa situated in the suture between the two laminæ. – The foramina of Stenson transmit the anterior palatine vessels, while the foramina of Scarpa transmit the naso-palatine nerves, of which the right one is said to be posterior to the left.

Under Surface – Concave, rough, forms part of roof of mouth. – Is channelled by a
Groove (sometimes by a canal) for the posterior palatine vessels & anterior or great palatine nerve, and presents behind anterior part of lower orifice of
Posterior palatine canal. †

Inner Border – Raised into a ridge which forms with its fellow a groove for vomer, and presents in front the
Anterior nasal spine.

Ant. Border – Forms lower part of anterior aperture of nasal fossæ.

Post. Border – Articulates with horizontal plate of palate bone.

†For foramina of Stenson & Scarpa, see Roof of mouth, p. 26.

THE PALATE BONE—1st Tablet.

Presents *horizontal* and *vertical plates*, –from the point of junction of which two plates the *pterygoid process* projects backwards & outwards, –while from the upper border of the vertical plate project upwards, the *orbital process* in front, and the *sphenoidal process* behind.
It articulates with *its fellow*, *the superior maxilla*, *sphenoid*, *ethmoid*, *inferior turbinated* & *vomer*.
It assists in forming –principally, the *floor & outer wall of the nasal fossa and the roof of the mouth*, and –secondarily, the *floor of the orbit*, *the pterygoid & spheno-maxillary fossæ*, *and the inner wall of the Antrum of Highmore*.

HORIZONTAL PLATE — Presents:

SUP. OR NASAL SURFACE – Smooth and concave from side to side, forms posterior part of floor of nasal fossa.

INF. OR BUCCAL SURFACE – Rough, marked posteriorly by a
Transverse ridge for attachment of aponeurosis of tensor palati, and more externally by a
Deep notch, which assists in forming the posterior palatine foramen. A little further back, on the under surface of the pterygoid process, are the
External & posterior small palatine foramina for external and posterior palatine nerves.

ANTERIOR BORDER – Serrated for articulation with palate process of superior maxilla.

POSTERIOR BORDER – Free for attachment of soft palate.

INNER BORDER – Thick, surmounted by a ridge, which forms with its fellow a groove for vomer; presents posteriorly the
Posterior nasal spine for azygos uvulæ.

VERTICAL PLATE — Presents:

INNER SURFACE – Presents the
Superior & middle turbinated crests, above, between & below which are seen
A narrow & two wider horizontal grooves, which form part respectively of the superior, middle & inferior meatuses.

OUTER SURFACE – Presents towards its middle a
Smooth surface, which forms the inner wall of the spheno-maxillary fossa, and is prolonged inferiorly into a
Vertical groove, which assists in forming the posterior palatine canal. In front of these is a
Rough surface, which articulates with the superior maxilla; and further forwards still a
Narrow smooth surface, which forms part of inner wall of antrum. Behind is a
Rough surface, which articulates above with the pterygoid process of the sphenoid, below with the superior maxilla.

ANTERIOR BORDER – Thin, irregular, presents a projecting lamina, the
Maxillary process, which assists in closing the lower part of the orifice of the antrum, and, forming a schindylesis, penetrates into a fissure of the superior maxilla at the lower part of that orifice.

POSTERIOR BORDER – Articulates with the inner plate of the pterygoid process.

UPPER BORDER – Presents the
Orbital process in front, the *Sphenoidal process* behind, which processes are separated by a deep
Notch forming the greater part of the spheno-palatine foramen (which foramen is completed above by the sphenoidal turbinated bone).

THE PALATE BONE—2nd Tablet.

PTERYGOID PROCESS — Fits into the notch between the two plates of the pterygoid process of the sphenoid bone, and presents:

Posterior Surface – Triangular, concave, forms part of pterygoid fossa.

Two Lateral Surfaces – Rough, articulate with the two plates of the pterygoid process & with the superior maxilla.

Under Surface – Forms part of the roof of the mouth, and presents the *External & posterior small palatine foramina* for external & posterior palatine nerves.

ORBITAL PROCESS — Projects upwards & outwards from the anterior part of the upper border of the vertical plate, and presents:

Three articular Surfaces – *Anterior, posterior & internal,* – which join respectively with the *superior maxillary bone, the sphenoidal turbinated bone & the lateral mass of the ethmoid.*

Two Non-articular Surfaces:–

Superior or Orbital – Forms posterior part of floor of orbit;

External or Spheno-maxillary – Forms part of inner wall of spheno-maxillary fossa, and is separated from the foregoing by a *Rounded border*, which forms part of spheno-maxillary fissure.

SPHENOIDAL PROCESS — Curves upwards, backwards & inwards, and presents:

Upper Surface – Articulates with sphenoid & sphenoidal turbinated bones, and assists in forming pterygo-palatine canal.

Outer Surface – Articulates behind with pterygoid process, and forms in front that small part of inner wall of spheno-maxillary fossa, which lies behind spheno-palat. foramen

Inner Surface – Concave, forms part of outer wall of nasal fossa.

THE SMALL BONES of the FACE.

NASAL BONES — Form bridge of nose. – Narrow & thick above, wide and thin below. Present:

Outer Surface – Convex from side to side, concave from above downwards at upper part. Presents several arterial grooves and a foramen for a small vein.

Inner Surface – Inversely curved; presents a groove for external branch of nasal nerve.

Borders:

SUPERIOR – Narrow, thick, articulates with frontal;

INFERIOR – Broad, thin, joined to lateral cartilage of nose; has a notch for nasal nerve;

EXTERNAL – Articulates with nasal process of superior maxillary bone;

INTERNAL – Thick, articulates with its fellow; is prolonged backwards into a crest which articulates with nasal spine of frontal & perpendicular plate of ethmoid.

LACHRYMAL BONES — Form front part of inner wall of orbit. Present;

Outer Surface – Presents from before backwards:

Groove, which forms part of nasal duct;

Ridge, which gives attachment to tensor tarsi muscle;

Smooth surface, which forms part of inner wall of orbit.

Inner Surface – Presents a furrow corresponding to foregoing ridge; forms part in front of middle meatus, and articulates behind with ethmoid bone.

Borders:

ANTERIOR, SUPERIOR, POSTERIOR – Articulate respectively with nasal & internal angular processes of superior maxillary & frontal bones, and with os planum of ethmoid.

INFERIOR – Articulates behind with orbital plate of superior maxillary, and, in front, is prolonged downwards into a pointed process, *the hamulus lachrymalis*, which articulates with lachrymal process of inferior turbinated bone.

MALAR BONES — Articulate with temporal, frontal, sphenoid & superior maxillary bones, and form part of outer wall & floor of orbit, and of temporal & zygomatic fossæ. Present:

Outer Surface – Convex; presents a small malar foramen for malar branch of temporo-malar nerve, and gives attachment to the zygomatic muscles.

Inner Surface – Articulates internally with superior maxillary bone by a rough triangular surface, and is concave externally, where forms part of temporal & zygomatic fossæ and presents a foramen for temporal branch of temporo-malar nerve.

Orbital Process – Projects backwards forming part of outer wall & floor of orbit & of temporal fossa; articulates from above downwards with frontal, sphenoid & superior maxillary bones, and bounds spheno-maxillary fissure anteriorly. – On its inner surface it presents one or two temporo-malar foramina.

Frontal Process – Thick, vertical, articulates with external angular process of frontal.

Zygomatic Process – Long, horizontal, articulates with zygomatic process of temporal.

Borders:

ANTERO-SUPERIOR – Forms lower & outer part of circumference of orbit.

ANTERO-INFERIOR – Articulates with superior maxillary bone.

POSTERO-SUPERIOR & POSTERO-INFERIOR – Are continuous with superior and inferior margins of zygomatic process.

INFERIOR TURBINATED BONES — Thin, and extend along whole length of outer wall of nasal fossa. Present:

Outer concave & **Inner** convex **Surfaces**, marked by vascular grooves and canals, and the latter of which looks upwards & inwards.

Upper Border – Which, from before backwards:

Articulates with inferior turbinated crest of superior maxillary;

Forms *lachrymal process*, which articulates with lachrymal & superior maxillary bones and completes nasal duct;

Presents *maxillary process*, which curves downwards and outwards over lower edge of orifice of antrum of Highmore.

Presents *ethmoidal process*, which ascends to join unciform process of ethmoid.

Lower Border – Is free and slightly thickened.

VOMER — Forms posterior part of nasal septum, and is frequently bent to one or other side. Presents:

Lateral Surfaces – Present vascular & nervous furrows, and naso-palatine groove for naso-palatine nerve.

Superior Border – Presents a deep groove bounded by two projecting *alæ*, between which the rostrum of the sphenoid is received, and which are overlapped inferiorly by the vaginal processes of the same bone.

Inferior Border – Articulates with ridge formed by palate plates of superior maxillary & palate bones.

Anterior Border – Is grooved above for articulation with perpendicular plate of ethmoid and joined below to cartilage of the septum.

Posterior Border – Free, thicker above than below; separates posterior apertures of the nares

INFERIOR MAXILLARY BONE.

is curved upon itself, and consists of a middle horizontal portion, the body, and of two lateral vertical portions, the rami.

BODY — Presents:

EXT. SURFACE — Convex from side to side and concave from above downwards. Presents in median line the

Symphysis, a vertical ridge, at the lower part of which is the

Mental process, from which the

External oblique line passes backwards, first horizontally, giving attachment to depressores labii inferioris & anguli oris, and then obliquely & becoming continuous with anterior border of ramus. – Laterally above the oblique line is the

Incisive fossa for levator menti; and more externally the

Mental foramen for mental vessels & nerve.

The Buccinator is attached above oblique line behind, and the platysma, below it, in front.

INT. SURFACE — Concave from side to side and convex from above downwards. Presents the

Symphysis forming a linear depression, close to which near its middle are the superior & inferior pairs of

Genial tubercles giving attachment respectively to the genio-hyo-glossi & genio-hyoidei. Below these tubercles begins the

Internal oblique line or *mylo-hyoid ridge* for mylo-hyoid muscle, faintly marked at first, but becoming more distinct as it passes upwards & backwards. – Above & below this line are seen near the symphysis the

Sublingual fossa for sublingual gland;

Rough depression for anterior belly of digastric; and more externally

Submaxillary fossa for submaxillary gland.

Above posterior extremity of mylo-hyoid ridge is attached the superior constrictor of the pharynx.

SUP. BORDER — Thickest behind, where it is dejected inwards; presents sixteen alveolæ in the adult, ten in the child.

INF. BORDER — Thickest and slightly everted anteriorly.

RAMI — Are quadrilateral, and present:

EXT. SURFACE — Marked by oblique ridges for masseter.

INT. SURFACE — Presents near middle

Aperture of inferior dental canal, of which the anterior margin forms a prominent

Spine for internal lateral ligament of lower jaw; – and from which passes downwards & forwards the

Mylo-hyoid groove for mylo-hyoid vessels & nerve, behind which groove is a

Rough surface for internal pterygoid muscle.

UPPER BORDER — Presents the coronoid & condyloid processes separated by sigmoid notch.

Coronoid process – Triangular, gives attachment by its surfaces & borders to temporal muscle, and presents at its lower & front part a groove which is continued downwards upon the alveolar process, and which gives attachment inferiorly to the buccinator muscle.

Condyloid process – Consists of

Condyle – Oblong, convex from side to side and from before backwards & nearly transverse, its long axis when prolonged, meeting that of its fellow near anterior margin of foramen magnum.

Neck – Flattened from before backwards, convex behind, excavated in front for external pterygoid muscle, presenting externally a tubercle for external lateral ligament of jaw.

ANTERIOR BORDER — Continuous with external oblique line; thin above, thicker below where grooved for buccinator.

LOWER & POSTERIOR BORDERS — Thick and form inferiorly the

Angle of the jaw, which gives attachment to masseter & internal pterygoid muscles and to stylo-maxillary ligament.

HYOID BONE.

Horse-shoe shaped, and suspended by stylo-hyoid ligaments from tips of styloid processes of temporal bones. Consists in youth of five parts, the body and the greater & lesser cornua, which parts are joined together by four arthrodiæ; the cornua usually join with the body, the greater ones towards the middle period of life, the lesser ones in advanced age.

BODY — Quadrilateral. Presents:

Anterior Surface – Convex, looks upwards & forwards, and is marked by a crucial ridge. The part above the ridge gives attachment to the hyo-glossus, genio-hyo-glossus & genio-hyoid; the part below the ridge gives attachment to the mylo-hyoid, the stylo-hyoid & the aponeurosis of the digastric.

Posterior Surface – Smooth, concave; looks backwards & downwards, and is separated from the epiglottis & the thyro-hyoid membrane by a quantity of loose areolar tissue, in which a bursa is usually found.

Upper Border – Thick & rounded; gives attachment to genio-hyo-glossus by its anterior lip, to thyro-hyoid membrane by its posterior lip.

Lower Border – Thinner; gives attachment to sterno-, omo-, & thyro-hyoid.

GREATER CORNU — Projects backwards & slightly upwards, giving attachment superiorly to the hyo-glossus, internally to the middle constrictor of the pharynx, and externally to the thyro-hyoid. It diminishes in size from before backwards, and is flattened from above downwards. Its slightly enlarged extremity gives attachment to the lateral thyro-hyoid ligament.

LESSER CORNU — Small, conical; projects upwards & backwards from point of junction of body & greater cornu, and gives attachment to the stylo-hyoid ligament.

SKULL AND FACE IN GENERAL.

UNDER SURFACE of BASE of SKULL.

Is bounded from before backwards by:
Alveolar arch & teeth of upper jaw;
Lower border of malar bone, zygoma & imaginary line from zygoma to mastoid process;
Superior curved line of occipital bone.

Grouping points of interest on under surface of skull, the latter may be said to present from before backwards:

Roof of Mouth;
Posterior Aperture of Nares:
Under Surface of Basilar Process, on each side of which is a
Quadrilateral Space, the angles of which are formed by the CONDYLE of the occipital bone, and by the PTERYGOID, ZYGOMATIC and MASTOID PROCESSES.
Under Surface of Remaining Part of Occipital Bone.

ROOF OF THE MOUTH

Is formed by palate processes of superior maxillary & horizontal plates of palate bones, and is bounded laterally & in front by alveolar arch.

Is concave, uneven & marked by a crucial suture, and presents from before backwards & outwards:

Lower opening of anterior palatine canal, into which may be seen to open, laterally
Foramina of Stenson for anterior palatine vessels, and in middle line,
Foramina of Scarpa for naso-palatine nerves;
A groove leading to
Posterior palatine foramen for post. palatine vessels & ant. or great palatine n.;
Transverse ridge for attachment of aponeurosis of tensor palati;
Accessory or small palatine foramina, posterior & external, for posterior or small, and the external palatine nerves.

POSTERIOR APERTURE OF THE NARES

Is bounded by body of sphenoid, horizontal plate of palate bone, and inner plates of pterygoid processes, which latter present inferiorly

Hamular process for reflection of tendon of tensor palati, and superiorly,
Scaphoid fossa for origin of that muscle.

Is divided into two by vomer, and presents inferiorly
Posterior nasal spine for origin of azygos uvulæ, and superiorly
Expanded alæ of vomer, which articulate with rostrum & with vaginal processes of sphenoid, and on either side of which are
Pterygo-palatine canals formed in part by sphenoid & in part by palate bones, and giving passage to pterygo-palatine vessels & nerves.

UNDER SURFACE OF THE BASILAR PROCESS

Presents in middle line
Pharyngeal spine for median raphe & superior constrictor of pharynx, and laterally,
Rough depressions for insertion of recti capitis antici major & minor.

QUADRILATORAL SPACE—V. next Tablet.

UNDER SURFACE OF THE OCCIPITAL BONE (REMAINING PART)—Presents:

Foramen magnum for cord & its membranes, vertebral arteries & spinal accessory nerves, on outer side of which foramen are
Condyles of occipital bone having
Jugular process on their outer side,
Anterior condyloid foramen in front,
Posterior condyloid fossa sometimes perforated by the *posterior condyloid foramen* behind.

Ext. Occipital Crest giving off laterally
Superior & Inferior curved lines, and ending posteriorly in
External occipital protuberance,
For parts just mentioned see Occipital Bone.

QUADRILATORAL SPACE.

Is formed by the under surfaces of the occipital bone and of the squamous & petrous portions of the temporal and of the greater wing of the sphenoid, and is situated on either side of the basilar process.

It is quadrangular.

ITS ANGLES

Are formed by the Condyles of the occipital bone and by the Pterygoid, Zygomatic & Mastoid processes. (Vide these parts in respective Tablets.)

It is divided in two by a well marked diagonal line obliquely directed from before backwards & outwards, and presents points of interest both in front of & behind its diagonal line.

ITS DIAGONAL LINE

Extends from the root of the pterygoid to the mastoid process, and presents from before backwards & outwards the

Foramen lacerum medium closed by cartilage, and crossed superiorly by the internal carotid artery & the Vidian nerve;

Rough surface for origin of levator palati & tensor tympani;
Inf. orifice of Carotid Canal;
Vaginal process;
Styloid process, which gives attachment to the stylo-hyoid & -maxillary ligaments and from above downwards to the stylo-pharyngeus, -hyoideus & -glossus muscles:
Stylo-mastoid foramen for facial nerve & stylo-mastoid artery.

IN FRONT & on the OUTER SIDE of the DIAGONAL LINE

Are found from before backwards & outwards the
Foramen ovale for inferior maxillary & small petrosal nerves and small meningeal artery, and on inner side of which is sometimes found the
Foramen Vesalii for a small vein;
Foramen Spinosum for middle meningeal artery;
Spine of the Sphenoid for internal lateral ligament of jaw & laxator tympani m.
Openings of the canal for the tensor tympani muscle (above) & of the osseous portion of the Eustachian tube (below).
Glenoid fossa divided by Glaserian fissure into
Anterior part, covered with cartilage which latter is prolonged over the emimentia articularis;
Posterior part non articular, and bounded behind by the vaginal & auditory processes and the middle root of the zygoma.

BEHIND & on the INNER SIDE of the DIAGONAL LINE

Are the:
Jugular fossa for internal jugular vein. This fossa assists in forming the
Jugular foramen or Foramen Lacerum posterius, of which the
Anterior or inner part, smaller and separated from the remainder by a bony ridge, transmits anteriorly the inferior petrosal sinus, and posteriorly, the glosso-pharyngeal, pneumo-gastric & spinal accessory nerves, while the
Posterior part, the larger, transmits the internal jugular vein;
Jugular process for rectus capitis lateralis & lateral occipito-atloid ligament. This process has in front of it & to its inner side the
Anterior condyloid foramen for hypoglossal nerve; behind it & to its inner side the
Posterior condyloid fossa sometimes perforated by *posterior condyloid foramen* for a small vein to lateral sinus.
Openings for Jacobson's & Arnold's nerves, and opening of Aqueductus Cochleæ.

INNER SURFACE of BASE of SKULL.

Presents three fossæ.

ANTERIOR FOSSA — The highest.

Formed by orbital plates of frontal, cribriform plate of ethmoid, lesser wings and front part of upper surface of body of sphenoid.

Presents the sutures between the foregoing bones, and in median line and from above downwards and then backwards:

Front part of groove for superior longitudinal sinus,
Frontal crest,
Foramen cæcum,
Crista galli,
A slightly elevated ridge.

On the side of the two latter is the
Olfactory groove deep in front, where it is formed by cribriform plate of ethmoid, and presents
Three rows of foramina for olfactory nerves,
Slit-like opening for nasal nerve,
Anterior & posterior ethmoidal foramina for nasal nerve and anterior & posterior ethmoidal arteries.

MIDDLE FOSSA — Vide next Tablet.

POSTERIOR FOSSA — The deepest.

Formed by occipital, petrous & mastoid portions of temporal and posterior inferior angle of parietal, and bounded in front by dorsum sellæ & superior border of petrous bones, and behind, by grooves for lateral sinuses.

Presents the sutures between the foregoing bones, and in the centre:

Foramen magnum for cord and its membranes, spinal accessory nerves & vertebral arteries.

In Front of the Foramen Magnum is the

Basilar groove, which supports medulla oblongata & pons, and on the sides of which are the *petro-occipital sutures,* which are grooved in front for inferior petrosal sinuses and expanded behind into jugular foramen or foramen lacerum posterius.

Behind the Foramen Magnum is the

Internal occipital crest, which separates the two
Inferior occipital fossæ, and ends in the
Internal occipital protuberance, which is situated at point of junction of the
Grooves for lateral sinuses, and to which corresponds the torcular Herophili.

On the Sides of Foramen Magnum are the

Anterior condyloid foramina for hypoglossal nerves, and, occasionally, the
Posterior condyloid foramina for a small vein to lateral sinus;
Jugular foramen or foramen lacerum posterius, of which the
Anterior or inner part, smaller and separated from the remainder by a bony ridge, transmits anteriorly the inferior petrosal sinus, and posteriorly the glosso-pharyngeal, pneumogastric & spinal accessory nerves, while the
Posterior part, larger, transmits the internal jugular vein;
Posterior surface of petrous portion of temporal bone presenting
Internal auditory meatus for facial nerve and auditory artery & n.,
Slit-like aperture of Aqueductus Vestibuli for small artery & vein and a process of dura mater

MIDDLE FOSSA of BASE of SKULL.

Is narrow in median line & expanded laterally.

Is formed by body & greater wings of sphenoid, squamous portion and anterior surface of petrous portion of temporal and anterior inferior angle of parietal, and is bounded by lesser wings of sphenoid & anterior margin of optic groove, in front, and by superior border of petrous bones behind.

Presents the sutures between foregoing bones and

In Median Line from before backwards:

Optic groove leading on either side to
Optic foramen for optic nerve & ophthalmic artery,
Olivary process,
Sella turcica on each side of which is the
Cavernous groove,
Dorsum sellæ presenting at its upper angles the
Posterior clinoid processes.

Laterally:

Cerebral eminences & depressions, and *grooves* for middle meningeal artery; and more internally, and from before backwards:
Sphenoidal fissure or foramen lacerum anterius for 3rd, 4th & 6th nerves, and ophthalmic nerve & vein,
Foramen rotundum for superior maxillary nerve,
Foramen ovale for inferior maxillary & small superficial petrosal nerves and small meningeal artery, (on inner side of which latter foramen is sometimes seen
Foramen Vesalii for a small vein),
Foramen spinosum for middle meningeal artery,
Foramen lacerum medium closed with cartilage.

On Anterior Surface of Petrous Bone:

Internal orifice of carotid canal,
Depression for Casserian ganglion,
Grooves to Hiatus Fallopii for large superficial petrosal nerve and to a smaller and more external opening for small superficial petrosal nerve; frequently
Two other small foramina for small petrosal branch of glosso-pharyngeal and branch of glosso-pharyngeal to large superficial petrosal nerve,
Eminence corresponding to superior semi-circular canal, on outer side of which is a
Depression corresponding to cavity of tympanum.

LATERAL REGION of the SKULL.

Presents from behind forwards the:
Mastoid process;
Ext. auditory meatus;
Zygomatic arch & ramus of the jaw, which two latter arch over the temporal, zygomatic & spheno-maxillary fossæ.

TEMPORAL FOSSA

Is formed by the temporal, frontal, & malar bones, the great wing of the sphenoid, & the anterior inferior angle of the parietal, and is deeply excavated below & in front.
Is bounded above by the temporal ridge, and opens widely below into the zygomatic fossa, the boundary line between the two being the zygomatic arch & the pterygoid ridge.

ZYGOMATIC FOSSA

Is an irregular and imperfectly enclosed space, the incomplete walls of which are formed on the anterior, inner, upper & outer aspects respectively by the
Tuberosity of the sup. maxillary bone,
Ext. pterygoid plate,
Under surface of great wing of sphenoid as far as pterygoid ridge, and *squamous portion of temporal bone.*
Zygomatic arch & ramus of lower jaw.
Communicates with temporal fossa beneath the zygoma, and with the orbit & spheno-maxillary fossæ through the spheno-maxillary & pterygo-maxillary fissures.

Spheno-Maxillary Fissure – Is bounded by superior maxillary, great wing of sphenoid, malar & palate bones, and joins internally at right angles with pterygo-maxillary fissure.
Opens up communications between the orbit and the temporal, zygomatic & spheno-maxillary fossæ.
Transmits infraorbital artery, superior maxillary nerve & ascending or orbital branches of Meckel's ganglion.

Pterygo-Maxillary Fissure – Is comprised between pterygoid process & tuberosity of superior maxillary bone.
Joins superiorly at right angles with spheno-maxillary fissure.
Transmits internal maxillary artery from zygomatic to spheno-maxillary fossa.

SPHENO-MAXILLARY FOSSA — Is the narrow & vertically elongated space comprised between the pterygoid process & the maxillary tuberosity, and bounded above & internally by the body of the sphenoid & the vertical plate of the palate bone.
Its upper part is the point of meeting of the sphenoidal, spheno-maxillary & pterygo-maxillary fissures.
It communicates with the cranium, orbit, zygomatic & nasal fossæ by the foramen rotundum & spheno- & pterygo-maxillary fissures & the spheno-palatine foramen, and has, opening into it, the vidian, pterygo-palatine, posterior palatine & accessory posterior palatine canals.

THE ORBIT.

Quadrilateral pyramidal fossa looking forwards & outwards and formed by seven bones, the frontal, ethmoid, sphenoid (which enter into formation of both orbits), superior maxillary, malar, lachrymal & palate.

Communicates with cranium, and with nasal, temporal, zygomatic & spheno-maxillary fossæ through optic foramen, nasal duct & spheno-maxillary fissure.

Presents:

ROOF — Formed by orbital plate of frontal & lesser wing of sphenoid. Is concave, and presents the suture between the foregoing bones, and in front the

Lachrymal fossa for lachrymal gland, and a

Depression (fovea trochlearis) for pulley of superior oblique.

FLOOR — Formed by upper or orbital surface of superior maxillary and orbital processes of malar & palate bones. Presents the sutures between foregoing bones, the

Infra-orbital groove for infra-orbital vessels & nerve, which becomes converted in front into *Infra-orbital canal;* and also at its anterior & inner part a

Depression for inferior oblique muscle.

INNER WALL — Formed from before backwards by nasal process of superior maxillary, lachrymal, os planum of ethmoid, body of sphenoid. Is antero-posterior in direction and parallel to its fellow, and presents the sutures between foregoing bones and the

Lachrymal groove for lachrymal sac,

Crest of lachrymal bone for tensor tarsi muscle.

OUTER WALL — Formed in front by orbital process of malar bone, and behind by anterior or orbital surface of great wing of sphenoid. Is very oblique forwards & outwards being nearly at right angles with its fellow, and presents the suture between foregoing bones, and the

Orifices of one or two malar canals,

Small spine for lower head of external rectus.

ANGLES:

SUP. EXTERNAL – Presents:

Articulation of frontal with malar bone & orbital plate of sphenoid,

Sphenoidal fissure or *foramen lacerum anterius* for 3rd, 4th & 6th nerves and ophthalmic nerve & vein.

SUP. INTERNAL – Presents

Suture connecting frontal with lachrymal & os planum, in which suture are the *Anterior ethmoidal canal* for nasal nerve & anterior ethmoidal vessels, and the *Posterior ethmoidal canal* for posterior ethmoidal vessels.

INF. EXTERNAL – Presents

Spheno-maxillary fissure for infra-orbital vessels & nerve and ascending branches of Meckel's ganglion.

INF. INTERNAL – Presents

Articulation of superior maxillary & palate bones with lachrymal & os planum.

CIRCUMFERENCE OR BASE — Quadrilateral, looks forwards & outwards. Is bounded by supra-orbital arch and external & internal angular processes of frontal, anterior border of orbital surface & nasal process of superior maxillary, and anterior border of malar bone. Presents

Supra-orbital notch or foramen for supra-orbital vessels & nerve; and assists in forming *Lachrymal groove* for lachrymal sac.

APEX — Corresponds to optic foramen for optic nerve & ophthalmic artery.

THE NASAL FOSSÆ.

Two narrow irregular cavities comprised between the orbits & superior maxillary bones, and between the roof of the mouth & the front part of the base of the skull.
Formed by ethmoid, sphenoid, frontal, superior maxillary, nasal, palate, inferior turbinated & vomer (all the bones of the face except malar & inferior maxillary).
Communicate with orbit (nasal duct), mouth, (anterior palatine canal), cranium (olfactory foramina), spheno-maxillary fossa (spheno-palatine foramen), and with the frontal, ethmoidal, sphenoidal, & maxillary sinuses. – Present:

ROOF — Narrow, and is from before backwards:
Oblique upwards & backwards and formed by nasal bone & nasal spine of frontal,
Horizontal and formed by cribriform plate of ethmoid,
Oblique downwards & backwards and formed by body of sphenoid. – Presents the sutures between the foregoing bones and from before backwards:
Groove on nasal bone for outer branch of nasal nerve;
Half crest for perpendicular plate of ethmoid;
Olfactory foramina & nasal slit for olfactory and nasal nerves;
Openings of sphenoidal sinuses partly closed by sphenoidal turbinated bones;
Articulation of alæ of vomer with body of sphenoid.

FLOOR — Concave from side to side, and formed by palate processes of superior maxillary & palate bones. – Presents the suture between foregoing bones & the
Upper orifice of the anterior palatine canal;
Half crest for vomer, which terminates in front & behind in the
Anterior & posterior nasal spines.

INNER WALL — Formed principally by the perpendicular plate of the ethmoid above & in front, and by the vomer below & behind, and secondarily by nasal spine of the frontal, rostrum of sphenoid, crests of superior maxillary, nasal & palate bones. Has an angular deficiency in front which is filled up by the cartilage of the septum. – Is frequently inclined to one or other side; and presents the sutures between the foregoing bones and
Vascular & nervous furrows &
Naso-palatine groove for naso-palatine nerve.

OUTER WALL — Formed by:
Lachrymal bone & nasal process of superior maxillary;
Inner surface of ethmoid, superior maxillary & inferior turbinated bones;
Vertical plate of palate bone & inner plate of pterygoid process. – Presents the sutures between the foregoing bones and from above downwards:
Superior turbinated process of ethmoid;
Superior meatus, into which open the sphenoidal & posterior ethmoidal sinuses and the spheno-palatine foramen. – Both are short and are situated at the posterior and upper part of the nares;
Middle turbinated process of ethmoid;
Middle meatus, larger than foregoing, into which open the Antrum of Highmore and through the infundibulum, the anterior ethmoidal cells & frontal sinuses;
Inferior turbinated bone;
Inferior meatus, the largest, presents in front the opening of the nasal duct.

UPPER LIMB.

I.

AXILLA; FRONT OF ARM.

THE MAMMA.

Rudimentary in the male, small in the female before puberty; increases in size during pregnancy & after delivery. – Presents:

POSTERIOR SURFACE, or BASE — Somewhat concave; nearly circular, but slightly elongated from below upwards & outwards. Rests upon pectoralis major & fascia covering it, and extends from 3rd rib to the 6th or 7th, and from side of sternum to axilla.

ANTERIOR SURFACE — Presents, a little below its middle, the nipple surrounded by the areola.

Nipple – Cylindrical or conical; presents at its apex the openings of the lactiferous ducts. Its surface is of a pink or brownish hue, wrinkled, provided with papillæ, and, near its base, with some sebaceous glands. It is susceptible of a sort of erection due mainly to the contraction of its muscular fibres.

Areola – Rosy in the virgin; larger & darker in colour after the second month of pregnancy & during lactation (when its sebaceous glands enlarge considerably), and also somewhat so during the remainder of life.

CUTANEOUS NERVES.

Superficial Descending – Several large branches from 3rd & 4th.
Descend between sterno-mastoid & trapezius, and divide into branches:

Sternal – Cross origin of sterno-mastoid to integument of front of chest as far as middle line.

Clavicular – Cross clavicle (sometimes one of them perforates the bone) to integument over pectoralis major & deltoid, communicating with cutaneous branches of the superior intercostal nerves.

Acromial – Over acromion & clavicular origin of trapezius to integument of outer & back part of shoulder.

Lateral Cutaneous – Pierce intercostals & serratus magnus midway between vertebræ & sternum, and divide into: –

Anterior Offset – Forwards to integument of side of chest & mamma, and to upper digitations of external oblique.

Posterior Offset – Backwards to integument over latissimus dorsi & scapula.

The posterior offset of the lateral cutaneous branch of the 2nd intercostal nerve, is called the *intercosto-humeral nerve*. It crosses the axilla, joins with lesser internal cutaneous nerve or nerve of Wrisberg & with internal cutaneous branch of musculo-spiral, and pierces deep fascia to integument of upper inner & back part of arm; its size varies inversely with that of the nerve of Wrisberg. There is frequently a second intercosto-humeral nerve derived from the 3rd intercostal.

Anterior Cutaneous – The termination of intercostal trunk. Pierce internal intercostals & pectoralis major by side of sternum, and turn outwards to integument of mamma & front of chest. The second joins with the clavicular branches of the superficial cervical plexus.

MUSCLES of UPPER LIMB—1st TABLET.

ANTERIOR THORACIC REGION.

Pectoralis Major – Anterior surface of inner half of clavicle; corresponding half of front of sternum; cartilages of all the true ribs except 1st or 7th or both; aponeurosis of external oblique.

Anterior or outer edge of bicipital groove of humerus. – S. by internal & external anterior thoracic nerves.

Pectoralis Minor – Outer surface & upper border of the 3rd 4th & 5th ribs near their extremities.

Inner border of coracoid process of scapula. – S. by internal anterior thoracic nerve.

Subclavius – Cartilage of first rib in front of rhomboid ligament.

Groove on under surface of middle third of clavicle. – S. by one of the supra-clavicular branches of brachial plexus.

LATERAL THORACIC REGION.

Serratus Magnus – By nine digitations from outer surface & upper border of eight upper ribs (the 2nd rib having two digitations).

Whole length of anterior lip of posterior border of scapula, the two upper digitations being inserted into triangular smooth surface on anterior aspect of superior angle, the three middle digitations into posterior border between superior & inferior angles, and the four lower digitations into anterior aspect of inferior angle. – S. by posterior or long thoracic nerve or external respiratory nerve of Sir C. Bell.

Latissimus Dorsi – Spinous processes of the 6 or 7 lower dorsal vertebræ; by the posterior layer of lumbar aponeurosis, from the lumbar & sacral spines and the back part of outer lip of crest of ilium; from outer lip of crest of ilium for an inch or more in front of lumbar aponeurosis; from the last three or four ribs interdigitating with external oblique; sometimes by a few fibres from inferior angle of scapula.

Bottom of bicipital groove of humerus a little higher up than teres major by a broad flat tendon twisted upon itself. – S. by long subscapular nerve.

AXILLARY ARTERY

From outer border of first rib to lower border of tendons of teres major & latissimus dorsi, being either straight or slightly curved upwards or downwards according to position of limb, and lying deeply at its origin & superficially at its termination.

May be divided into three parts:

First Part – Above pectoralis minor; rests upon thoracic wall.

Second Part – Behind pectoralis minor; passes obliquely from thorax to arm.

Third Part – Below pectoralis minor; lies on inner side of neck of humerus.

RELATIONS:

FIRST PART:

In front – Pectoralis major, costo-coracoid membrane; cephalic & acromio-thoracic veins; external anterior thoracic nerve.

Behind & on Inner Side – First intercostal space, first digitation of serratus magnus, posterior thoracic nerve.

On Inner Side & in Front – Axillary vein.

On Outer Side – Brachial plexus.

SECOND PART:

In Front – Pectorales major & minor.

Behind – Upper part of subscapularis & posterior cord of brachial plexus.

On Inner Side – Axillary vein & inner cord.

On Outer Side – Coraco-brachialis & outer cord.

THIRD PART:

In Front – Pectoralis major (except at lowest part), junction of the two heads of median nerve.

Behind – Lower part of subscapularis, tendons of teres major & latissimus dorsi, musculo-spiral & circumflex nerves.

On Inner Side – Axillary vein, inner head of median, ulnar, internal cutaneous & lesser internal cutaneous nerves.

On Outer Side – Coraco-brachialis, outer head of median nerve, musculo-cutaneous nerve.

BRANCHES of the AXILLARY ARTERY

Vary considerably in mode of origin, size & number. Are still usually described after Haller as being given off as follows, from

FIRST PART:

Sup. Thoracic — Small. Inwards along upper border of pectoralis minor, and then between latter muscle & pectoralis major; anastomoses with intercostales & internal mammary.

Acromio-thoracic — Short, thick, from fore part of artery. Forwards to upper border of pectoralis minor, and divides into branches:

Acromial – Join with suprascapular & with both circumflex.

Thoracic – Two or three. To pectorales & serratus magnus, and join with intercostales & internal mammary.

Humeral – One, rather large. Downwards with cephalic vein between pectoralis major & deltoid.

SECOND PART:

Long Thoracic or Ext. Mammary — Large branch. Along lower border of pectoralis minor to mamma, pectorales & serratus, and to axillary glands & subscapularis. Joins with the other thoracic & with subscapular.

Alar Thoracic — Small & often wanting. To axillary glands & cellular tissue.

THIRD PART:

Subscapular — The largest branch. Along lower border of subscapularis to lower angle of scapula, where joins with posterior scapular. Gives off twigs to surrounding muscles, and

Dorsalis Scapulæ – Arises an inch & a half from origin of subscapular. Round outer border of scapula between teres major, teres minor, & long head of triceps, and then between teres minor & the bone. Gives off:

Branches to subscapular fossa between subscapularis & bone; join with posterior- & suprascapular.

Descending br. between teres major & minor.

Branches to infraspinous fossa; join with posterior- & suprascapular.

Ant. Circumflex — The smaller. Outwards beneath coraco-brachialis, short head of biceps & deltoid, giving off twig to shoulder joint; joins with following & with acromial branch of acromio-thoracic.

Post. Circumflex — The larger. Through quadrangular space between teres major, teres minor, long head of triceps & humerus, and round neck of humerus beneath deltoid. Gives twigs to shoulder joint, and joins with preceding & with acromial branch of acromio-thoracic.

BRACHIAL PLEXUS.

Formed as follows by anterior divisions of 5th, 6th, 7th, & 8th cervical and 1st dorsal ns.:
Fifth & Sixth Cervical unite between anterior & middle scaleni, and form the OUTER PRIMARY CORD.
Eighth & First Dorsal unite behind scalenus anticus, and form the INNER
Seventh forms alone the MIDDLE PRIMARY CORD. [PRIMARY CORD.
All three primary cords divide into *anterior & posterior divisions.*
Anterior divisions of *outer & middle* primary cords form the OUTER CORD.
Anterior division of *inner* primary cord forms the INNER CORD.
Posterior divisions of *all three* primary cords form the POSTERIOR CORD.

Broad between anterior & middle scaleni, where anterior divisions of the nerves lie above 2nd part of subclavian artery; contracted opposite clavicle, where inner & outer cords lie at fore part of plexus on outer side of 3rd part of subclavian artery & of 1st part of axillary; again expanded in axilla, where the three cords lie on inner, outer & posterior aspects of 2nd part of axillary, and where they break up into the large nerves of upper limb.

Communicates with the cervical plexus through loop between 4th & 5th nerves & through branch from 5th nerve to phrenic, and with middle & inferior ganglia of sympathetic.

BRANCHES — Are

ABOVE THE CLAVICLE:

Post. or Long Thoracic, or Ext. Respiratory of Sir C. Bell – From 5th & 6th nerves, the two roots uniting in substance of scalenus medius.
Deeply along side of chest behind axillary vessels & cords of brachial plexus as far as lowest digitation of serratus magnus.

Suprascapular – From back of trunk formed by union of 5th & 6th.
Backwards & outwards beneath trapezius & through suprascapular foramen to supraspinous fossa, where lies between supraspinatus & the bone.
Round spine of scapula to infraspinous fossa. – Supplies supra- & infraspinati (two twigs to each), shoulder-joint & scapula.

Muscular – To rhomboidei & frequently to levator anguli scapulæ (from 5th nerve), subclavius (from 5th & 6th, anastomoses frequently with phrenic), scaleni & longus colli (variably from 6th 7th & 8th.)

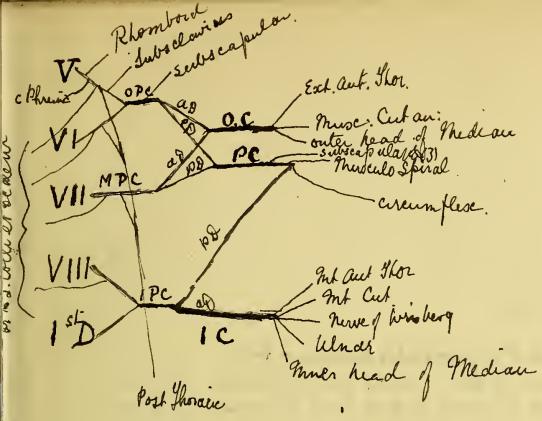
Communicating – From 5th cervical to phrenic on anterior scalenus.

BELOW THE CLAVICLE — The branches are given off from the three cords as follows, from:

Outer Cord – External anterior thoracic, outer head of median, musculo-cutaneous or external cutaneous.
Inner Cord – Internal anterior thoracic, inner head of median, ulnar, internal cutaneous, lesser internal cutaneous or n. of Wrisberg.
Posterior Cord – The three subscapular nerves, musculo-spiral & circumflex

Anterior Thoracic Nerves – Two, connected together by a loop on inner side of axillary artery.
EXTERNAL OR SUPERFICIAL – The largest. Crosses both axillary artery & vein to under surface of pectoralis major.
INTERNAL OR DEEP – The smallest. Between artery & vein, and gives twigs to under surface of both pectorales.

Subscapular Nerves – Three:
UPPER – The smallest; to upper part of subscapularis.
LOWER – To lower border of subscapularis & to teres major; the latter muscle having sometimes a separate nerve.
LONG – The largest. Along lower border of subscapularis to latissimus dorsi.



MUSCLES of UPPER LIMB—2nd TABLET.

ANTERIOR BRACHIAL REGION.

Biceps:

SHORT HEAD – Tip of coracoid process of scapula in common with coraco-brachialis.

LONG HEAD – Top of glenoid cavity of scapula & glenoid ligament.

Back part of bicipital tuberosity of the radius. – S. by musculo-cutaneous nerve.

Coraco-brachialis – Tip of coracoid process of scapula in common with short head of biceps.

Rough impression a little above middle of inner surface of shaft o humerus. – S. by musculo-cutaneous nerve.

Brachialis Anticus – Lower half of inner & outer surfaces of shaft of humerus; front of internal & external intermuscular septa.

Under surface of coronoid process of ulna. – S. by musculo-cutaneous & musculo-spiral nerves.

BRACHIAL ARTERY

Commences at lower border of tendons of teres major & latissimus dorsi.

Down inner & anterior aspects of arm in groove along inner border of coraco-brachialis & biceps, lying at first on inner side, and then in front of, humerus,– its more precise direction being marked by a line drawn from outer side of axilla to midway between condyles of humerus

Divides into radial & ulnar half an inch below bend of elbow, or opposite neck of radius.

RELATIONS:

ALONG THE ARM:

In front – Skin and fascia, inner border of coraco-brachialis & biceps; median nerve.

Behind – Long and inner heads of triceps, superior profunda artery & musculo-spiral nerve; coraco-brachialis, brachialis anticus.

On Inner Side – Skin & fascia, internal cutaneous nerve, basilic vein; ulnar nerve in upper part, median nerve in lower part.

On Outer Side – Coraco-brachialis & biceps, humerus in upper part.

AT BEND OF ELBOW:

In front – Skin, superficial fascia, median basilic vein, branches of anterior division of internal cutaneous nerve; bicipital or semilunar fascia.

Behind – Brachialis anticus & elbow joint.

On Inner Side – Pronator radii teres, median nerve.

On Outer Side – Tendon of biceps, supinator longus, musculo-cutaneous & musculo-spiral nerves.

BRANCHES:

Muscular — Irregular, to coraco-brachialis, biceps & brachialis anticus.

Nutritious — From near middle of artery. Enters nutrient canal near insertion of coraco-brachialis, and descends towards lower extremity of the bone.

Sup. Profunda — From upper part of artery. With musculo-spiral nerve in groove of same name between inner & outer heads of triceps, and then between supinator longus & brachialis anticus, where joins with radial recurrent. Gives off muscular branches, and an articular branch to back of elbow joint, which joins with interosseous & posterior ulnar recurrent, and with inferior profunda or anastomotica magna.

Inf. Profunda — Small, from near middle of artery. With ulnar nerve through internal intermuscular septum, and then between inner condyle & olecranon; anastomoses with posterior ulnar recurrent & anastomotica magna.

Anastomotica Magna — From lower part. Through internal intermuscular septum, and round back of humerus forming an arch above olecranon fossa with articular branch of superior profunda. Joins with anterior & posterior ulnar recurrent & with inferior profunda.

UPPER LIMB.

II.

FRONT OF FOREARM.

PALM OF HAND.

SUPERFICIAL VEINS.

Radial – Commences at outer side of arch on dorsum of hand. Receives branches from back of thumb & index finger, ascends along front of outer side of fore-arm, communicating with median, and joins at bend of elbow with median cephalic to form the cephalic.

Anterior Ulnar – Commences on anterior aspect of wrist & inner side of palm of hand, ascends along front of inner side of fore-arm communicating with posterior ulnar & median, and, at bend of elbow, joins with posterior ulnar, & then with median basilic, to form the basilic.

Posterior Ulnar – Commences at inner side of arch on dorsum of hand, receiving vena salvatella from little finger, ascends along back of inner side of forearm, and, at bend of elbow, joins with anterior ulnar, & then with median basilic, to form the basilic.

Median – Commences in superficial structures of palm of hand, ascends along middle of front of fore-arm communicating with radial & anterior ulnar, and, after receiving a large branch from venæ comites of brachial, divides at bend of elbow into median cephalic & median basilic.

Median Cephalic – Usually the smaller. Ascends in groove between biceps & supinator longus, lying mainly in front of branches of anterior division of external cutaneous nerve, and joins with radial vein to form the cephalic.

Median Basilic – Usually the larger. Ascends in groove between biceps & pronator radii teres, being more or less surrounded by branches of anterior division of internal cutaneous nerve, and lying in front of brachial artery, from which it is separated by bicipital or semilunar fascia.

Cephalic – Somewhat smaller than basilic. Ascends in groove along outer border of biceps and then in interspace between pectoralis major & deltoid, in which latter situation it is accompanied by humeral or descending branch of acromio-thoracic artery, and ends in axillary vein between coracoid process & clavicle, its opening being guarded by a pair of valves. It communicates sometimes with external jugular or subclavian by a small branch which ascends in front of clavicle.

Basilic – Somewhat larger than cephalic. Ascends in groove along inner border of biceps, pierces deep fascia with internal cutaneous nerve a little below middle of arm, and ends in one of the brachial veins or in the axillary.

N.—Numerous varieties are observed in the disposition of the veins of the bend of the elbow: the median vein with both its terminal branches may be entirely wanting, or, the vein itself being wanting, its two terminal branches may be supplied either by the radial or the anterior ulnar.

MUSCLES of FRONT of FOREARM.

SUPERFICIAL LAYER.

Pronator Radii Teres.
LARGE OR SUPERFICIAL HEAD – Inner condyle & inner border of humerus immediately above it, deep fascia of forearm, intermuscular septum between it & flexor carpi radialis.
SMALL OR DEEP HEAD – Ridge on inner surface of coronoid process of ulna below flexor sublimis digitorum.
Rough impression on middle of outer surface of shaft of radius. – S. by median nerve.

Flexor Carpi Radialis – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.
Front of base of 2nd metacarpal bone, & slightly into that of 3rd. – S. by median nerve.

Palmaris Longus – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.
Anterior annular ligament of carpus and palmar fascia. – S. by median nerve.

Flexor Carpi Ulnaris.
ANTERIOR OR INNER HEAD – Inner condyle by common tendon; deep fascia; intermuscular septum between it & palmaris longus.
POSTERIOR OR OUTER HEAD – Inner border of olecranon, and by an aponeurosis which is common to it & to the flexor profundus, from upper two-thirds of posterior border of shaft of ulna.
Pisiform bone and slightly into annular ligament & base of 5th metacarpal bone. – S. by ulnar nerve.

Flexor Sublimis Digitorum.
INNER HEAD – Inner condyle by common tendon, and internal lateral ligament of elbow-joint.
MIDDLE HEAD – Tubercle on inner surface of coronoid process of ulna above pronator radii teres.
OUTER HEAD – Oblique line on front of radius.
Sides of second phalanges. – S. by median nerve.

DEEP LAYER:

Flexor Profundus Digitorum – Depression on inner side of coronoid process of ulna, upper two-thirds of anterior & inner surfaces, and, by an aponeurosis which is common to it & to flexor carpi ulnaris, from upper two-thirds of posterior border of shaft of ulna; inner half of interosseous membrane.
Bases of third phalanges. – S. partly by ulnar nerve, partly by anterior interosseous branch of median nerve.

Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft of radius; outer half of interosseous membrane; occasionally by a small slip from inner side of coronoid process.
Base of last phalanx of thumb. – S. by anterior interosseous branch of median nerve.

Pronator Quadratus – Lower fourth of anterior surface & inner border of ulna; aponeurosis which covers inner third of the muscle.
Lower fourth of anterior surface & outer border of radius. – S. by anterior interosseous branch of median nerve

MUSCLES of OUTER SIDE of FOREARM.

Supinator Longus – Upper two-thirds of external condyloid ridge of humerus, external intermuscular septum.
Outer side of base of styloid process of radius. – S. by musculo-spiral n.

Extensor Carpi Radialis Longior – Lower third of external condyloid ridge of humerus, external intermuscular septum.
Back of base of second metacarpal bone. – S. by musculo-spiral nerve.

Extensor Carpi Radialis Brevior – External condyle of humerus by a tendon common to it & to superficial muscles of back of forearm; external lateral ligament of elbow-joint; deep fascia; intermuscular septa on either side.
Back of base of third metacarpal bone. – S. by posterior interosseous n.

RADIAL ARTERY

The smaller branch of bifurcation of brachial half an inch below bend of elbow or opposite neck of radius.
Down front of outer side of forearm to a little to inner side of styloid process of radius.
Round outer side of carpus beneath extensor tendons of thumb.
Through upper part of first interosseous space between the two heads of abductor indicis.
Over bases of metacarpal bones & interossei, and beneath flexor tendons, lumbricales & nerves to base of 5th metacarpal bone, where inosculates with communicating branch of ulnar, forming deep palmar arch. Lies a finger's breadth above level of superficial palmar arch.

RELATIONS in FOREARM:

In Front – Skin, superficial fascia, deep fascia, supinator longus.
Behind – Tendon of biceps, supinator brevis, pronator radii teres, flexor sublimis digitorum, flexor longus pollicis, pronator quadratus, lower end of radius.
On Outer Side – Supinator longus, radial nerve in middle third.
On Inner Side – Pronator radii teres, flexor carpi radialis.

BRANCHES:

IN FOREARM:

Radial recurrent — From upper part. Between brachialis anticus & supinator longus, and anastomoses with interosseous recurrent & superior profunda.

Muscular — Numerous, to muscles on either side.

Ant. carpal — From lower part. Joins with anterior carpal branch of ulnar beneath deep flexor tendons; gives twigs to articulations of carpus.

Superficialis volæ — From termination of artery in forearm. Small, and ends in muscles of thumb; or of more considerable size, and joins with & completes superficial palmar arch.

ON BACK OF WRIST:

Post. carpal — Over back of carpus beneath extensor tendons. Joins with posterior carpal branch of ulnar to form posterior carpal arch, which anastomoses with termination of anterior interosseous artery of forearm, and gives off:

Dorsal Interosseous Arteries of Third & Fourth Spaces – Anastomose at upper part of interosseous spaces with perforating branches of deep palmar arch. – Are usually exhausted in sheaths of tendons, interossei & integument over back of first phalanges, but are sometimes larger than usual, and are then prolonged upon dorsum of fingers in the shape of dorsal digital branches similar to those of thumb & outer side of index, and of toes.

Metacarpal, or Dorsal Interosseous Art. of Second Space — Arises beneath extensor tendons of thumb, sometimes in common with posterior carpal, and is similar to, but larger than, the foregoing interosseous arteries.

Dorsales pollicis / **Dorsalis indicis** — Correspond together to a first dorsal interosseous artery. The former supplies dorsal digital branches to both sides of back of thumb, the latter forms the dorsal digital branch of outer side of back of index.

IN PALM OF HAND:

Princeps pollicis / **Radialis indicis** — Correspond together to a first palmar interosseous artery. The former supplies palmar digital branches to both sides of front of thumb, the latter forms the palmar digital branch of outer side of front of index.

Perforating — Three. Through upper part of three inner interosseous spaces, and anastomose with corresponding dorsal interosseous arteries.

Deep palmar interosseous — Usually three or four, but very variable in size & number. Descend in front of interosseous spaces, join with superficial palmar interosseous branches from superficial palmar arch, and then bifurcate to form palmar digital branches to 3½ fingers on inner side of hand

ULNAR ARTERY

The larger branch of bifurcation of brachial half an inch below bend of elbow, or opposite neck of radius.

Deeply to near middle of inner border of forearm, lying upon brachialis anticus & flexor profundus and beneath median nerve and all the superficial muscles except flexor carpi ulnaris, and being at a distance from ulnar nerve.

Beneath skin and fascia only along front of inner border of forearm, lying, with ulnar nerve on its inner side, between flexor carpi ulnaris & flexor sublimis digitorum.

Over anterior annular ligament on outer side of pisiform bone & slightly in front of nerve.

Crosses palm of hand beneath skin & fascia and in front of flexor tendons & divisions of median & ulnar nerves, forming superficial palmar arch. This arch lies on a level with lower border of abducted thumb, a finger's breadth below deep palmar arch, and usually joins with superficialis volæ or radialis indicis, or sometimes with princeps pollicis.

BRANCHES:

Ant. ulnar recurrent — Small. Between pronator radii teres & brachialis anticus, and anastomoses with inferior profunda & anastomotica magna.

Post. ulnar recurrent — Larger. Beneath flexor sublimis, and then between olecranon & inner condyle beneath flexor carpi ulnaris, and anastomoses with interosseous recurrent, and with inferior profunda & anastomotica magna.

Interosseous — Thick, an inch in length, to upper border of interosseous membrane, where divides into:

ANT. INTEROSSEOUS — Down front of interrosseous membrane with corresponding branch of median nerve and between flexors longus pollicis & profundus digitorum. Behind pronator quadratus, and through lower part of interosseous membrane to back of carpus, where joins with posterior interosseous & posterior carpal arch. – Gives off a long slender twig to median nerve, and their nutrient arteries to radius & ulna.

POST. INTEROSSEOUS — Between interosseous membrane & oblique or round ligament, and then between superficial & deep muscles of back of forearm to back of carpus, where anastomoses with termination of anterior interosseous & with posterior carpal arch; gives off

INTEROSSEOUS RECURRENT — Beneath anconeus & supinator brevis to interval between olecranon & external condyle, and anastomoses with superior profunda & posterior ulnar recurrent.

Ant. Carpal — Joins with anterior carpal branch of radial beneath deep flexor tendons; gives twigs to articulations of carpus.

Post. carpal — Beneath tendon of flexor carpi ulnaris, and over back of carpus beneath extensor tendons, joining with posterior carpal branch of radial, and forming posterior carpal arch (Vide Radial artery). Sends a small branch along metacarpal bone of little finger.

Communicating — Between abductor & flexor brevis minimi digiti, and joins with termination of radial to complete deep palmar arch.

Superficial palmar interosseous (DIGITAL) — Usually four, but rather variable in size & number. Descend with terminal branches of median & ulnar nerves, first in front of, and then between, the flexor tendons (and on inner side of the innermost), and join with deep palmar interosseous branches from deep palmar arch. The trunks thus formed divide at clefts between fingers to form digital branches to 3½ fingers on inner side of hand.

MEDIAN & MUSCULO-CUTANEOUS NERVES.

MEDIAN NERVE.

From inner & outer cords of brachial plexus by two roots which surround 3rd part of axillary artery. – Lies at first on outer side (more or less so, but never quite in front) of 3rd part of axillary & upper part of brachial arteries.

Crosses brachial artery usually in front, and lies on its inner side at bend of elbow.

Between the two heads of pronator radii teres, and down middle of front of forearm, lying deeply at first between flexor sublimis & flexor profundus digitorum, and then superficially between tendon of flexor carpi radialis & outermost tendons of flexor sublimis.*

Beneath anterior annular ligament to palm of hand, where lies in front of flexor tendons, and becomes enlarged and flattened, and divides into two

TERMINAL BRANCHES:

External – Supplies abductor, opponens & outer head of flexor brevis pollicis, and gives palmar digital branches to thumb & outer side of index finger.

Internal – Supplies the two outer lumbricales, and gives palmar digital branches to contiguous sides of index, middle and ring fingers. – The digital nerves are superficial to the digital arteries.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Muscular – Arise near elbow; to all the superficial muscles of front of fore-arm except flexor carpi ulnaris.

Ant. Interosseous – With anterior interosseous artery between flexor longus pollicis & flexor profundus digitorum, supplying the former & the outer half of the latter, and ends in pronator quadratus.

Palmar Cutaneous – From lower part. Pierces deep fascia a little above anterior annular ligament and supplies integument of palm of hand & ball of thumb, joining with palmar cutaneous branch of ulnar, and with radial or anterior branch of external cutaneous.

MUSCULO-CUTANEOUS or EXTERNAL CUTANEOUS NERVE.

From outer cord of brachial plexus in common with outer head of median.

Through coraco-brachialis, and between biceps & brachialis anticus to a little above external condyle, where perforates deep fascia, and divides, behind median cephalic vein, into:

Anterior Branch – Along front of radial side of fore-arm as low as wrist, where lies in front of radial artery, and joins with radial nerve. Sends filaments over ball of thumb, and accompanies radial artery to back of carpus.

Posterior Branch – Along back of radial side of fore-arm, joining with radial and with external cutaneous branch of musculo-spiral.

Supplies coraco-brachialis, biceps & brachialis anticus, and sends twigs to humerus & to elbow-joint.

*When palmaris longus is present, the nerve lies between it & flexor carpi radialis.

ULNAR, INT. CUTANEOUS, & LESSER INT. CUTANEOUS NERVES.

ULNAR NERVE.

From inner cord of brachial plexus in common with inner head of median, internal cutaneous & lesser internal cutaneous nerves. – Lies at first on inner side of 3rd part of axillary & upper part of brachial arteries.

Pierces internal intermuscular septum with inferior profunda, and descends in groove between olecranon & internal condyle.

Enters fore-arm between the two heads of flexor carpi ulnaris.

Descends on flexor profundus, being covered in upper part of fore-arm by flexor carpi ulnaris, lying superficially in lower part between tendon of latter muscle & innermost tendons of flexor sublimis digitorum. – Ulnar artery lies on outer side of nerve, and is distant from it in upper part of fore-arm.

Crosses anterior annular ligament a little behind artery & on outer side of pisiform bone, and divides into two

TERMINAL BRANCHES:

Superficial – To palmaris brevis, integument & 1½ fingers on inner side of hand, joining with median.

Deep – Between abductor & flexor brevis minimi digiti, and beneath flexor tendons with deep palmar arch. Supplies muscles of little finger, interossei, the two inner lumbricales, adductor pollicis & inner head of flexor brevis.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Articular to Elbow Joint – Several, small, arise behind elbow.

Muscular – To flexor carpi ulnaris & inner half of flexor profundus.

Palmar Cutaneous – Arises a little below middle of fore-arm. With ulnar artery to integument of front of wrist & palm of hand, joining with palmar cutaneous branch of median & frequently with internal cutaneous.

Dorsal Cutaneous – Large, arises a little above wrist. Winds inwards beneath tendon of flexor carpi ulnaris, and supplies integument & 1½ fingers on inner side of back of hand, joining with radial.

Articular to the Wrist.

INTERNAL CUTANEOUS NERVE.

From inner cord of brachial plexus in common with inner head of median, ulnar & lesser internal cutaneous nerves.

Along inner side of brachial artery in front of lesser internal cutaneous, giving off a cutaneous filament to integument over biceps.

Pierces deep fascia with basilic vein, and divides into:

Anterior Branch – In front of, or sometimes behind, median basilic vein to integument of front of inner side of fore-arm as low as wrist, frequently joining with palmar cutaneous branch of ulnar.

Posterior Branch – Over internal condyle to integument of back of inner side of fore-arm to near wrist, joining with lesser internal cutaneous & dorsal cutaneous branch of ulnar.

LESSER INTERNAL CUTANEOUS N. or N. of WRISBERG.

From inner cord of brachial plexus in common with inner head of median, ulnar & internal cutaneous nerves.

Along inner side of axillary vein & brachial artery & behind internal cutaneous nerve to integument of back of lower third of arm, joining with intercosto-humeral & posterior branch of internal cutaneous.

Its size & communications vary considerably. Frequently intercosto-humeral nerve is large, and takes the place of nerve of Wrisberg, joining brachial plexus by a small filament only, or not at all.

MUSCLES of PALM of HAND.

MUSCLES of the THENAR EMINENCE or MS. of the THUMB.

Abductor Pollicis or Trapezo-phalangeal – Ridge on anterior surface of trapezium & anterior annular ligament of wrist.
Outer side of base of first phalanx of thumb. – S. by median nerve.

Opponens Pollicis or Trapezo-metacarpal – Front of trapezium below the ridge, & annular ligament.
Whole length of outer border of metacarpal bone of thumb. – S. by median n.

Flexor Brevis Pollicis or Trapezocarpo-phalangeal.
Outer or Superficial Head – Lower part of trapezium & anterior annular ligament.
Inner or Deep Head – Trapezoides, os magnum, base of 2nd & 3rd metacarpal bones.
Either side of base of first phalanx of thumb, a sesamoid bone being developed in each tendon. – S. by median nerve, & deep branch of ulnar.

Adductor Pollicis or Metacarpo-phalangeal – Lower two-thirds of anterior surface of 3rd metacarpal bone.
Inner side of base of first phalanx of thumb. – S. by deep branch of ulnar n.

MS. of HYPO-THENAR EMINENCE or MS. of LITTLE FINGER.

Palmaris Brevis – Annular ligament & inner edge of central palmar fascia.
Skin over inner border of hand. – S. by superficial branch of ulnar nerve.

Abductor Minimi Digiti, or Pisi-phalangeal – Pisiform bone, and slightly from tendon of flexor carpi ulnaris.
Inner side of base of first phalanx of little finger. – S. by deep branch of ulnar nerve.

Flexor Brevis Minimi Digiti, or Unci-phalangeal – Unciform process of unciform bone & annular ligament.
Inner side of base of first phalanx of little finger. – S. by deep branch of ulnar nerve.

Opponens or Adductor Minimi Digiti, or Unci-metacarpal* – Unciform process of unciform bone & annular ligament.
Whole length of inner border of metacarpal bone of little finger. – S. by deep branch of ulnar nerve.

*These names, expressive of the origin & insertion of the corresponding muscles, are due to Cruveilhier.

MUSCLES of the CENTRAL PALMAR REGION.

Lumbricales – First, and sometimes Second, from outer side of corresponding deep flexor tendon. – Third and Fourth, from adjoining sides of 2nd & 3rd and 3rd & 4th deep flexor tendons respectively.
Outer side of expansion of corresponding extensor tendon on back of first phalanges. – S., the two outer by median nerve; the two inner by deep branch of ulnar nerve.

Palmar Interossei – Three. – They arise from palmar half of one side of the metacarpal bone of one finger, and are inserted into the same side of the base of the first phalanx of the same finger & into the expansion of the extensor tendon which covers it. – They are situated respectively on the inner side of the 2nd metacarpal bone & index finger, and on the outer side of the 4th & 5th metacarpal bones and corresponding ring & little fingers. They adduct these fingers towards an imaginary line drawn through the long or middle finger. – They are supplied by the deep branch of the ulnar nerve.

Dorsal Interossei – Four – They arise by two heads from the adjacent sides of two metacarpal bones, but more extensively from the side of that metacarpal bone, which corresponds to the finger into which the muscle is inserted. They are inserted into the corresponding side of the base of the first phalanx of the corresponding finger & into the expansion of the corresponding extensor tendon. – They are situated respectively on the outer side of the 2nd metacarpal bone & index finger, on both sides of the 3rd metacarpal bone & middle finger, on the inner side of the 4th metacarpal bone & ring finger. The 1st dorsal interosseous muscle is larger than the others, and is sometimes called the abductor indicis; the radial artery passes between its two heads. – They abduct the fingers from an imaginary line drawn through the long or middle finger. – They are supplied by the deep branch of the ulnar nerve.

UPPER LIMB.

III.

PARTS ABOUT SHOULDER, BACK OF UPPER LIMB.

MUSCLES of UPPER LIMB—5th Tablet.

Deltoid – Upper surface & anterior border of outer half of clavicle; upper surface & outer border of acromion; whole length of lower lip of posterior border of spine of scapula.

Rough triangular prominence a little above middle of outer surface of shaft of humerus. – S. by circumflex nerve.

Subscapularis – Inner two-thirds of subscapular fossa; tendinous laminæ attached to ridges of said fossa; aponeurosis which separates it from teres major.

Into lesser tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down. – S. by the two upper subscapular nerves from posterior cord of brachial plexus.

Supraspinatus – Inner two-thirds of supraspinous fossa & fascia which covers it.

Highest of the three facets on greater tuberosity of humerus. – S. by suprascapular nerve.

Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface; fasciæ which separate it from the teres major & minor.

Middle facet on greater tuberosity of humerus. – S. by suprascapular nerve.

Teres Minor – Upper two-thirds of dorsal aspect of axillary border of scapula; intermuscular septa which separate it from infraspinatus & teres major.

Lowest facet on greater tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down – S. by a branch of circumflex nerve.

Teres Major – Dorsal aspect of inferior angle of scapula; intermuscular septa which separate it from infraspinatus & teres minor.

Inner or posterior edge of bicipital groove of humerus. – S. by a branch from lower subscapular nerve.

Latissimus Dorsi – Spinous processes of the 6 or 7 lower dorsal vertebræ; by the posterior layer of lumbar aponeurosis, from the lumbar & sacral spines and the back part of outer lip of crest of ilium; from outer lip of crest of ilium for an inch or more in front of lumbar aponeurosis; from the last three or four ribs interdigitating with external oblique; sometimes by a few fibres from inferior angle of scapula.

Bottom of bicipital groove of humerus a little higher up than teres major by a broad flat tendon twisted upon itself. – S. by long subscapular nerve.

Levator Anguli Scapulæ – Posterior tubercles of transverse processes of the 3, 4, or 5 upper cervical vertebræ between splenius & scalenus medius.

Posterior border of scapula between spine & superior angle. – S. by one of the deep branches of the cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Rhomboideus Minor – Ligamentum nuchæ and spinous processes of 7th cervical & 1st dorsal vertebræ.

Posterior border of scapula opposite triangular smooth surface at root of spine. – S. by one of the deep branches of cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Rhmoboideus Major – Spinous processes of the 4 or 5 upper dorsal vertebræ and supra-spinous ligament.

Base of scapula between spine and inferior angle (Quain, Ellis), or rather into a tendinous arch attached to the triangular smooth surface at root of spine & to the inferior angle and connected to posterior border of scapula by a thin membrane (Gray). – S. by one of the deep branches of the cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

MUSCLES of UPPER LIMB—6th Tablet.

MUSCLES of BACK of FOREARM.

SUPERFICIAL LAYER.

Extensor Communis Digitorum – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.
Bases of 2nd & 3rd phalanges of the four fingers. – S. by posterior interosseous nerve.

Extensor Minimi Digiti – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.
Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of little finger. – S. by posterior interosseous nerve.

Extensor Carpi Ulnaris – External condyle of humerus by the common tendon; middle third of posterior border of shaft of ulna; deep fascia; septum between it & foregoing muscle. Usually it simply covers, but sometimes it arises from, narrow portion of posterior surface of shaft of ulna internal to the vertical ridge.
Base of metacarpal bone of little finger. – S. by posterior interosseous n.

Anconeus – Back of outer condyle of humerus; deep fascia.
Rough triangular surface on outer side of olecranon & upper third of shaft of ulna. – S. by musculo-spiral nerve.

DEEP LAYER.

Supinator Brevis – External condyle of humerus; external lateral ligament of elbow-joint; orbicular ligament of radius; triangular depression below lesser sigmoid cavity & ridge behind the depression.
Inner, anterior, and outer aspects of radius above bicipital tuberosity & oblique line as low down as insertion of pronator radii teres. – S. by posterior interosseous nerve.

Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface of shaft of ulna below insertion of anconeus; posterior surface of interosseous membrane; middle third of posterior surface of shaft of radius.
Base of first metacarpal bone. – S. by posterior interosseous nerve.

Extensor Primi Internodii Pollicis – Posterior surface of radius below foregoing muscle; interosseous membrane.
Base of first phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface of shaft of ulna; posterior surface of interosseous membrane.
Base of terminal phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Indicis – Posterior surface of shaft of ulna below foregoing muscle; interosseous membrane.
Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of index finger. – S. by posterior interosseous nerve.

POSTERIOR BRACHIAL REGION.

Triceps:

Long Head – Rough triangular depression below glenoid cavity of scapula, and slightly from capsule of shoulder-joint.

Outer Head – Posterior surface of shaft of humerus above musculo-spiral groove; outer border of humerus; external intermuscular septum.

Inner Head – Posterior surface of shaft of humerus below musculo-spiral groove; inner border of humerus; internal intermuscular septum.

By a strong tendon into back part of upper surface of olecranon process of ulna. – S. by musculo-spiral nerve.

Subanconeus – Posterior surface of humerus above olecranon fossa.
Posterior ligament of elbow joint – S. by musculo-spiral nerve.

MUSCULO-SPIRAL & CIRCUMFLEX NERVES.

MUSCULO-SPIRAL NERVE

The largest branch of brachial plexus. Arises from posterior cord in common with circumflex, and lies at first behind 3rd part of axillary artery & upper part of brachial.

Downwards & outwards in front of tendons of teres major & latissimus dorsi, and in spiral groove with superior profunda artery.

Between brachialis anticus & supinator longus to front of external condyle, where it divides into radial & posterior interosseous nerves. Its branches are:

Muscular – To triceps, anconeus, brachialis anticus, supinator longus, extensor carpi radialis longior.

Cutaneous – Three, small, one internal, two external; to integument of inner & posterior, and of outer & anterior aspects of arm, and of outer aspect of fore-arm.

RADIAL NERVE — The smaller.

Down front of outer side of fore-arm beneath supinator longus, lying on outer side of radial artery, which artery is distant from it in upper third & close to it in middle third. Winds outwards & backwards beneath tendon of supinator longus about three inches above wrist, pierces deep fascia, and divides into branches:

External – The smaller. To outer side & ball of thumb; joins with posterior branch of external cutaneous.

Internal – The larger. To integument, & remainder of 3½ fingers on outer side of hand; joins with external cutaneous & with dorsal cutaneous branch of ulnar. – Adjoining sides of middle & ring fingers may be supplied by same nerve, which may be either the radial or the ulnar.

POSTERIOR INTEROSSEOUS NERVE — The larger.

Through substance of supinator brevis to back of fore-arm.

Between superficial & deep muscles of posterior aspect of fore-arm, supplying them all except anconeus, supinator longus, & extensor carpi radialis longior.

Beneath extensores secundi internodii pollicis & communis digitorum to back of carpus, where it becomes ganglionic and supplies articulations of wrist.

CIRCUMFLEX NERVE

From posterior cord of brachial plexus in common with musculo-spiral.

Downwards & outwards behind axillary artery in front of subscapularis.

Backwards, with posterior circumflex vessels, through quadrilateral space bounded by teres major, teres minor, long head of triceps, & humerus. Gives off a small twig to shoulder-joint, and divides into:

Superior Branch – The larger. Round neck of humerus as far as anterior border of deltoid; supplies deltoid, and gives off cutaneous filaments which perforate the muscle to integument over lower part of shoulder.

Inferior Branch – The smaller. Supplies teres minor, back part of deltoid, & integument over back of shoulder; has frequently a gangliform enlargement on branch to teres minor.

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—1st T.

The muscles attached to the

CLAVICLE — Are six in number, and are attached as follows: –

Sterno-Cleido-Mastoid – Anterior surface & upper border of inner third.
Pectoralis Major – Anterior surface & anterior border of inner half.
Deltoid – Upper surface & anterior border of outer half.
Trapezius – Upper surface & posterior border of outer third.
Subclavius – Groove on under surface of middle third.
Sterno-Cleido-Hyoid – Sometimes, from back of inner extremity.

SCAPULA — Seventeen in number, and are attached as follows: –

Supraspinatus – Inner two-thirds of supraspinous fossa.
Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface.
Teres Major – Posterior aspect of inferior angle.
Teres Minor – Upper two-thirds of posterior aspect of axillary border.
Deltoid – Upper surface & outer border of acromion, whole length of lower lip of posterior border of spine.
Trapezius – Upper surface and inner border of acromion, whole length of upper lip of posterior border of spine.
Subscapularis – Inner two-thirds of subscapular fossa & ridges on its surface.
Serratus Magnus – Whole length of anterior lip of posterior border.
Rhomboideus Major – Posterior border between spine & inferior angle.
Rhomboideus Minor – Posterior border opposite triangular smooth surface at root of spine.
Levator Anguli Scapulæ – Posterior border between spine & superior angle.
Omo-Hyoid – Upper border on inner side of suprascapular notch.
Long Head of Triceps – Rough triangular depression below glenoid cavity.
Pectoralis Minor – Inner border of coracoid process.
Coraco-Brachialis, *Short Head of Biceps* – Tip of coracoid process.
Long Head of Biceps – Top of glenoid cavity.
Latissimus Dorsi – Sometimes, from back of inferior angle.

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—2nd T.

The muscles attached to the

HUMERUS — Are twenty-four in number, and are attached as follows: –

Supraspinatus – Highest of the three facets on greater tuberosity.
Infraspinatus – Middle facet on greater tuberosity.
Teres Minor – Lowest facet on greater tuberosity, and by a few fleshy fibres into the neck for a short distance lower down.
Subscapularis – Lesser tuberosity, and by a few fleshy fibres into the neck for a short distance lower down
Teres Major – Inner or posterior edge of bicipital groove.
Pectoralis Major – Anterior or outer edge of bicipital groove.
Latissimus Dorsi – Bottom of bicipital groove.
Deltoid – Rough triangular prominence a little above middle of outer surface of shaft.
Coraco-Brachialis – Rough impression a little above middle of inner surface of shaft.
Brachialis Anticus – Lower half of inner & outer surfaces of shaft.
Inner & Outer Heads of Triceps –
Inner head – Posterior surface of shaft below musculo-spiral groove, inner border.
Outer head – Posterior surface of shaft above musculo-spiral groove, outer border.
Supinator Longus – Upper two-thirds of external condyloid ridge.
Extensor Carpi Radialis Longior – Lower third of external condyloid ridge.
Extensor Carpi Radialis Brevior – External condyle.
Extensor Communis Digitorum – ,,
Extensor Minimi Digiti – ,,
Extensor Carpi Ulnaris – ,,
Anconeus – ,,
Supinator Brevis – ,,
Pronator Radii Teres (Inner Head) – Inner condyle & internal condyloid ridge im

Flexor Carpi Radialis – Inner condyle.
Palmaris Longus – ,,
Flexor Carpi Ulnaris (Anterior or Inner Head) – Inner condyle
Flexor Sublimis Digitorum (Inner Head) – ,,

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—3rd T.

The muscles attached to the

RADIUS — Are nine in number, and are attached as follows: –

Biceps – Back part of bicipital tuberosity.
Supinator Brevis – Inner, anterior & outer aspects of the bone above bicipital tuberosity & oblique line as low down as insertion of pronator radii teres.
Flexor Sublimis Digitorum (Outer Head) – Oblique line.
Pronator Radii Teres – Rough impression on middle of outer surface of shaft.
Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft.
Pronator Quadratus – Lower fourth of anterior surface & outer border.
Extensor Ossis Metacarpi Pollicis – Middle third of posterior surface of shaft.
Extensor Primi Internodii Pollicis – Posterior surface of shaft below foregoing.
Supinator Longus – Outer side of base of styloid process.

ULNA — Are thirteen in number, and are attached as follows: –

Supinator Brevis – Triangular depression below lesser sigmoid cavity & ridge behind the depression.
Brachialis Anticus – Under surface of coronoid process.
Flexor Sublimis Digitorum (Middle Head) – Tubercle on inner surface of coronoid process above pronator radii teres.
Pronator Radii Teres (Outer Head) – Ridge on inner surface of coronoid process below flexor sublimis.
Flexor Profundus Digitorum – Depression on inner surface of coronoid process, upper two-thirds of anterior & inner surfaces, and, by an aponeurosis which is common to it & to flexor carpi ulnaris, upper two-thirds of posterior border.
Flexor Carpi Ulnaris (Posterior Head) – Inner border of olecranon, and by an aponeurosis which is common to it & to flexor profundus, upper two-thirds of posterior border.
Triceps –Back part of upper surface of olecranon.
Anconeus – Rough triangular surface on outer side of olecranon & upper third of shaft.
Pronator Quadratus – Lower fourth of anterior surface & inner border.
Extensor Carpi Ulnaris – Middle third of posterior border. Usually it simply covers, but sometimes it arises from, narrow portion of posterior surface internal to the vertical ridge.
Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface below insertion of anconeus.
Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface.
Extensor Indicis – Posterior surface below foregoing.

THE SHOULDER-JOINT.

Is an enarthrodial articulation, though not a typical one; for the glenoid cavity of the scapula is, in comparison with the head of the humerus, remarkably small & shallow, and there is little more than a mere apposition between the two bones. Considerable mobility is thus provided for. Displacement is, on the other hand, prevented to a great extent by the presence of the acromion & coracoid processes & coraco-acromial ligament. — The articular cartilage is thickest in the centre, on the head of the humerus, thickest at the periphery, on the glenoid cavity.

LIGAMENTS:

Capsular – From
Neck of scapula round margin of glenoid cavity to
Anatomical neck of humerus, extending farthest down humerus along its inner aspect.

This capsule is thicker above than below. It is strengthened by the coraco-humeral ligament externally, by the tendons of the supra- & infraspinatus & teres minor behind, and by that of the subscapularis in front.

It has two, sometimes three openings, through which the synovial membrane is prolonged upon the tendons of the subscapularis & biceps, and sometimes upon that of the infraspinatus. The tendon of the long head of the biceps perforates the lower part of the capsule, and becomes surrounded, within the joint, by a complete sheath of synovial membrane.

It is remarkably loose, and, when the muscles are cut, it admits of the bones being separated more than an inch. The bones are therefore kept in apposition less by the ligaments themselves than by muscular action & atmospheric pressure.

Coraco-humeral, or Accessory – Strong flat band intimately blended with the capsule, and extending obliquely from
Root & outer border of coracoid process to
Front of great tuberosity of humerus.

Glenoid – Would be better described as an extension of the glenoid cavity than as a ligament, for, unlike the cotyloid ligament of the hip-joint, it does not assist in keeping the bones together. It is a fibro-cartilaginous ring triangular on section; its thickest portion is attached to the circumference of the glenoid cavity, and its sharp edge is free. It is continuous above with the tendon of the long head of the biceps, by the bifurcation of which it is partly formed.

SYNOVIAL MEMBRANE — Is prolonged through the above mentioned openings in the capsule
Upon the tendon of the biceps, in the shape of a complete sheath, which allows the tendon to traverse the articular cavity without being contained therein;
Upon the tendon of the subscapularis in the shape of a pouch of variable size comprised between the tendon & the subscapular fossa; and sometimes
Upon the tendon of the infra-spinatus in a similar manner; an independent bursa existing at other times between the muscle & the infraspinous fossa. – An independent bursa exists between the upper part of the capsule & the coraco-acromial ligament & deltoid.

VASCULAR & NERVE SUPPLY — From the circumflex & supra-scapular vessels & nerves.

MOVEMENTS — The shoulder joint is the freest of all the joints of the body, and admits of movement in every direction. The acromion & coracoid processes & the coraco-acromial ligament prevent displacement upwards of the head of the humerus, and limit, unless the scapula be displaced, the elevation of the arm to about the horizontal position.

THE ELBOW-JOINT.

Is a ginglymoid articulation between the trochlea & the radial tuberosity or capitellum of the humerus, on the one hand, and, on the other, the greater sigmoid cavity of the ulna & the cup-shaped depression on the head of the radius. – The articular surfaces of the radius & ulna are continuous with those of the superior radio-ulnar articulation.

LIGAMENTS — Are:

Anterior – Broad & pretty thick layer of superficial oblique & deeper vertical fibres extending from

Inner condyle & front of humerus just above coronoid fossa to
Orbicular ligament of radius & under surface of coronoid process of ulna, – to which vertical & oblique fibres a few transverse ones are added.

Posterior – Thin & membranous; consists of a few irregular fibres mainly transverse, which connect

Apex & sides of olecranon process to
Margin of olecranon fossa.

External Lateral – Thick, strong, triangular, shorter & narrower than the internal; from

External condyle to
Orbicular ligament of radius & outer border of ulna.

Internal Lateral – Thick, strong, triangular; longer & broader than foregoing, and divided into anterior & posterior portions extending respectively from

Front, and from *lower & back part of inner condyle*, respectively to
Inner border of coronoid process, and *inner border of olecranon.*

SYNOVIAL MEMBRANE — Lines the coronoid & olecranon fossæ, and dips down between the articular surfaces of the superior radio-ulnar articulation.

VASCULAR & NERVE SUPPLY – From the superior & inferior profunda, & the radial, ulnar & interosseous recurrent arteries, and from the ulnar & musculo-cutaneous nerves.

MOVEMENTS — Flexion & extension only, which are limited by the locking of the coronoid & olecranon processes in their respective fossæ. – The inner border of the trochlea descending lower than the outer one, the axis of rotation is oblique downwards & inwards; the path of motion lies, therefore, in a plane, oblique downwards & outwards, which circumstance, as is remarked by Cruveilhier, brings the hand during flexion naturally and without effort towards the mouth.

RADIO-ULNAR ARTICULATIONS.

Three in number, superior, middle, & inferior, the middle one consisting merely of two ligamen ts, the interosseous & the oblique or round.

SUPERIOR RADIO-ULNAR ARTICULATION — Lateral ginglymus or diarthrosis rotatorius between circumference of head of radius, on the one hand, and lesser sigmoid cavity & inner surface of orbicular ligament of radius, on the other, the lesser sigmoid cavity corresponding to the broad inner part, and the orbicular ligament to the narrow outer part of the radial articular surface. – The only ligament is the

Orbicular Ligament – Strong flat band, the four-fifths of a ring, which extends, round head & upper part of neck of radius, from
Anterior extremity to *Posterior extremity of lesser sigmoid cavity of ulna.*
The circumference of its lower border is narrower than that of its upper border, so that the head of the radius is maintained by it both against the ulna & against the capitellum of the humerus. Its inner surface is lined by the synovial membrane, and forms part of the articular surfaces of the joint. Its outer surface gives attachment to external lateral ligament of elbow-joint and to supinator brevis muscle.

MIDDLE RADIO-ULNAR ARTICULATION.

Interosseous Ligament – Strong aponeurotic plane of fibres which pass obliquely downwards & inwards between
Contiguous borders of radius & ulna.– It is broadest towards middle, perforated inferiorly for anterior interosseous vessels, and deficient above from about an inch below tubercle of radius, thus leaving for posterior interosseous vessels an opening bounded superiorly by the

Oblique or Round Ligament – Narrow fasciculus oblique downwards & outwards from
Coronoid process to
Radius half an inch below bicipital tuberosity.

INFERIOR RADIO-ULNAR ARTICULATON — Lateral ginglymus or diarthrosis rotatorius between head of ulna & sigmoid cavity of radius, to which is added an arthrodia between under surface of head of ulna & the triangular fibro-cartilage of the articulation. – The ligaments are:

Ant. Radio-Ulnar – Narrow band from
Anterior extremity of sigmoid cavity to
Front of head of ulna.

Post. Radio-Ulnar – Narrow band from
Posterior extremity of sigmoid cavity to
Back of head of ulna.

Triangular Fibro-Cartilage – The principal band of union, triangular, from
Lower margin of sigmoid cavity of radius to
Depression at root of styloid process of ulna.
Its upper & under surfaces are lined respectively with the synovial membranes of the inferior radio-ulnar & radio-carpal articulations, and they come in contact, the one with the head of the ulna, the other with the cuneiform bone. Its margins are blended with the surrounding ligaments. It is thinnest in the centre, and sometimes perforated; the two synovial membranes above mentioned are then continuous with each other.

Synovial Membrane – Is very loose, and is termed the *membrana sacciformis.* It extends between the triangular fibro-cartilage & the head of the ulna, and becomes continuous, when the former is perforated, with the synovial membrane of the wrist-joint.

THE WRIST-JOINT.

Is a condyloid articulation.

ARTICULAR SURFACES:

THE CONDYLE – Is formed by three bones, the scaphoid, semilunar, & cuneiform.

THE RECEIVING CAVITY – Is formed by the under surface of the radius & by the triangular fibro-cartilage of the inferior radio-ulnar articulation. – The under surface of the radius is divided by a linear elevation into two portions, the outer triangular, the inner quadrilateral, which portions correspond respectively to the scaphoid and the semilunar; the cuneiform articulates with the under surface of the triangular fibro-cartilage

LIGAMENTS:

External Lateral – Short strong band, from

Apex of styloid process of radius to

Outer side of scaphoid & trapezium, & anterior annular ligament of carpus.

Internal Lateral – Round cord, from

Apex of styloid process of ulna to

Cuneiform & pisiform bones, & anterior annular ligament.

Anterior – Strong & broad membrane, from

Front of head of ulna, anterior margin of radius & its styloid process to

Scaphoid, semilunar, cuneiform, & slightly to os magnum.

Posterior – Thinner, from

Posterior margin of radius to

Scaphoid, semilunar & cuneiform.

VASCULAR & NERVE SUPPLY — Anterior & posterior carpal branches of radial & ulnar, anterior & posterior interosseous arteries, ascending branches of deep palmar arch. – Ulnar nerve

MOVEMENTS — All but rotation.

FASCIÆ & SYNOVIAL MEMBRANES of the HAND & WRIST.

FASCIÆ — Are rather ligaments than fasciæ proper, and are therefore described here.

Anterior Annular Ligament of the Wrist – Continuous above with deep fascia of forearm, and below with palmar fascia; extends from

Pisiform bone & unciform process of unciform to
Tubercle of scaphoid, & ridge on anterior surface of trapezium.

It is pierced by tendon of flexor carpi radialis.

Beneath it pass the flexores sublimis & profundus digitorum enclosed in one synovial sheath, the flexor longus pollicis enclosed in another sheath, and the median n.

Into its anterior surface & upper border are inserted a few fibres of the palmaris longus & flexor carpi ulnaris.

From its lower border arise in part the abductor, opponens & outer head of flexor brevis pollicis, and the flexor brevis & opponens minimi digiti.

Posterior Annular Ligament of the Wrist – Thinner than foregoing, from

Cuneiform & pisiform bones, and lower part of ulna to
Styloid process & ridges on posterior aspect of radius.

Presents six divisions or compartments lined each of them with a separate synovial membrane, and which, from without inwards, correspond to the following osseous grooves, and transmit the following muscles: –

1. – *Corresponds to shallow groove on outer side of styloid process of radius. – Transmits extensores ossis metacarpi & primi internodii pollicis.*
2. – *Corresponds to broad & shallow groove on posterior aspect of styloid process. – Transmits extensores carpi radiales longior & brevior.*
3. – *Corresponds to narrow & deep groove on back of lower extremity of radius. – Transmits extensor secundi internodii pollicis.*
4. – *Corresponds to broad & shallow groove on back of lower extremity of radius. – Transmits extensores indicis & communis digitorum.*
5. – *Corresponds to groove at point of articulation of radius & ulna. – Transmits extensor minimi digiti.*
6. – *Corresponds to groove on back of head of ulna. – Transmits extensor carpi ulnaris.*

Palmar Fascia — Consists of

Two Lateral Portions – Thin. Cover muscles of thumb & little finger, and send processes between them.

Central Portion – Thick, strong, triangular; firmly adherent to integument; covers superficial palmar arch, flexor tendons, & median & ulnar nerves, and gives origin internally to palmaris brevis. It is narrow above, where it receives expanded tendon of palmaris longus, and is attached to anterior annular ligament; and broad below, where it divides into four slips bound together by transverse fibres. Each slip subdivides into two processes, which processes embrace the flexor tendons, and become attached to bases of first phalanges & glenoid ligaments. Between the slips are seen the palmar interosseous & digital arteries, the terminal branches of the median & ulnar nerves, & the tendons of the lumbricales.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Five: –

1. – *Membrana Sacciformis* of the inferior radio-ulnar articulation.
2. – *Synovial membrane of the radio-carpal articulation*, comprised between the first row of carpal bones & the under surface of the radius & triangular fibro-cartilage.
3. – *General synovial membrane of the carpus*, comprised between bones of first row, between bones of second row, between the two rows of bones, between the second row of carpal bones & the four inner metacarpal bones, and finally between the four inner metacarpal bones.
4. – *Synovial membrane of the carpo-metacarpal articulation of the thumb.*
5. – *Synovial membrane of the articulation between the cuneiform & pisiform.*

Tendinous – Vide Anterior & Posterior Annular Ligaments.

LOWER LIMB.

I.

FRONT & INNER SIDE OF THIGH.

MUSCLES of LOWER LIMB—1st Tablet.

ILIAC REGION.

Psoas Magnus – Bases of transverse processes of lumbar vertebræ, and by five slips from sides of bodies of lumbar & last dorsal vertebræ & from corresponding intervertebral substances; the slips being connected by tendinous arches which extend across the constricted part of the bodies of the vertebræ.
Lesser trochanter of femur. – S. by anterior branches of lumbar nerves.

Psoas Parvus – Sides of bodies of last dorsal & first lumbar vertebræ & corresponding intervertebral substance.
Ilio-pectineal eminence. – S. by anterior branches of lumbar nerves. – Is frequently absent.

Iliacus – Iliac fossa & inner lip of crest of ilium; ilio-lumbar ligament; base of sacrum; anterior superior & anterior inferior spines of ilium & notch between them; capsule of hip-joint.
Outer side of tendon of psoas, and upper part of line from lesser trochanter to linea aspera in front of pectineus. – S. by anterior crural nerve.

ANTERIOR FEMORAL REGION.

Tensor Vaginæ Femoris – Anterior superior spinous process and anterior part of outer lip of crest of ilium.
Fascia lata about ¼ down outer side of thigh. – S. by superior gluteal nerve.

Sartorius – Anterior superior spinous process of ilium & upper half of notch below it.
Upper part of inner surface of shaft of tibia covering tendons of gracilis & semitendinosus. – S. by middle or internal cutaneous branch of anterior crural nerve.

Rectus Femoris – Anterior inferior spinous process of ilium (straight tendon); groove above brim of acetabulum (reflected tendon).
Upper border of patella in common with vasti & crureus. – S. by anterior crural nerve.

Vastus Externus – Anterior border of great trochanter & horizontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera & line from linea aspera to outer condyle; external intermuscular septum.
Outer border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Vastus Internus – Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface of femur; internal intermuscular septum.
Inner border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Crureus – Anterior & outer surfaces of femur reaching from anterior intertrochanteric line to within a few inches of condyles.
Upper border of patella in common with rectus & vasti. – S. by anterior crural nerve.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: – line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner*, *anterior* and *outer* surfaces of shaft of femur; internal intermuscular septum; – and that it is inserted into tendon of rectus & borders of patella, and slightly into head of tibia.

Subcrureus – Lower part of anterior surface of femur.
Upper part of synovial membrane of knee-joint. – S. by anterior crural nerve.

FEMORAL ARTERY

Commences beneath Poupart's ligament midway between antero-superior spine of ilium & symphysis pubis, and a little to inner side of head of femur.
Passes down front & inner side of thigh, being at first at a distance from, and then close to, the shaft of the bone.
Terminates at junction of middle and lower thirds of thigh, becoming popliteal artery in opening in lower part of adductor magnus. – Some Authors describe a *common* femoral artery descending as low down as the origin of the *deep* femoral, the main trunk below this branch being called the *superficial* femoral.
Its direction is marked by a line drawn from midway between antero-superior spine of ilium and symphysis pubis to inner side of inner condyle of femur.

RELATIONS — Must be examined in Scarpa's triangle, or in upper third, and in middle third of thigh.

IN SCARPA'S TRIANGLE — The artery divides the triangle into two nearly equal parts, and has

In Front – Skin, superficial fascia, fascia lata (except opposite saphenous opening, where latter is replaced by cribriform fascia), sheath; internal cutaneous nerve & filaments of crural branch of genito-crural n.; inguinal lymphatic glands.

Behind – Posterior part of sheath; psoas, pectineus, adductor longus; profunda artery & vein.

On Inner Side at Upper Part – Femoral vein, which becomes posterior below.

On Outer Side – Psoas muscle, anterior crural & long saphenous nerves.

IN MIDDLE THIRD OF THIGH — It lies behind sartorius in Hunter's canal, –a deep depression between vastus internus & tendons of adductors longus & magnus closed in anteriorly by a band of fascia,–and has femoral vein behind it & to its outer side, and long saphenous nerve to its outer side & in front.

BRANCHES:

Superficial Epigastric — Arises close to Poupart's ligament. Through saphenous opening, and then upwards and inwards in superficial fascia of abdomen, and anastomoses with deep epigastric & internal mammary.

Superficial Circumflex iliac — Arises close to Poupart's ligament. Pierces fascia lata on outer side of saphenous opening, and upwards & outwards below Poupart's ligament to crest of ilium. Anastomoses with circumflex iliac & gluteal arteries.

Superficial or Sup. External Pudic — Arises near preceding. Inwards through saphenous opening, and then across spermatic cord or round ligament to integument of abdomen, penis & scrotum, or labia.

Deep or Inf. External Pudic — Arises with or near preceding. Inwards beneath fascia lata, which it pierces opposite pubes, to integument of perinæum & to scrotum or labia.

Profunda Femoris, or Deep Femoral — Vide p. 67.

Muscular Brs. — Numerous, and given off along entire course.

Anastomotica magna — Arises in Hunter's canal. Descends upon tendon of adductor magnus, and divides into:

Superficial Branch – With internal saphenous nerve to integument of inner side of knee.

Deep Branch – Through substance of vastus internus to inner side of front of knee, and anastomoses with superior internal & superior external articular arteries & with recurrent branch of tibial.

COLLATERAL CIRCULAT. — Is reestablished after ligature of the common femoral through the gluteal, ilio-lumbar & circumflex iliac arteries, which join with the external circumflex, through the obturator & sciatic, which join with the internal circumflex, through the comes nervi ischiadici, which join with the terminal & perforating branches of the profunda. – After ligature of the superficial femoral it is reestablished mainly through the deep femoral & its perforating branches, which join with the articular branches of the popliteal.

INTERNAL or LONG SAPHENOUS VEIN — Commences at inner side of arch on dorsum of foot. Accompanies long or internal saphenous nerve in front of internal malleolus, along inner side of leg, & behind inner condyle; it then inclines forwards along inner aspect of thigh, and, passing through saphenous opening, terminates in the femoral about an inch & a half below Poupart's ligament. It receives numerous cutaneous branches from leg & thigh, (the branches from inner aspect of thigh frequently uniting into one large trunk); and it also receives near its termination, the superficial epigastric, superficial circumflex iliac & superficial external pudic. It communicates with the internal plantar, anterior & posterior tibial, & femoral, and contains from two to six valves, which valves are usually more numerous in the thigh than in the leg.

ANTERIOR CRURAL NERVE.

The largest branch of lumbar plexus. — Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd.
Descends through substance of psoas, and emerges from lower part of its outer border.
Passes down between psoas & iliacus, giving off small branches to iliacus & femoral artery.
Enters thigh beneath Poupart's ligament half an inch to outer side of femoral artery, and divides into anterior & posterior divisions.

ANTERIOR DIVISION - Gives off:

Middle Cutaneous Nerve

- Pierces fascia lata & generally sartorius also (which muscle it then supplies) about *three or four inches below Poupart's ligament*, and divides into two branches to integument of front of thigh as low as knee. - Joins with crural branch of genito-crural, internal cutaneous & internal saphenous.

Internal Cutaneous Nerve

- Crosses upper part of sheath of femoral vessels giving off a few cutaneous filaments, and divides into:

Anterior or External Branch - Pierces fascia lata about *lower third of thigh*, and divides into branches to integument of inner & outer sides of knee; joins with middle cutaneous & long saphenous.

Inner or Posterior Branch - Along posterior border of sartorius, joining in a plexiform network beneath fascia with long saphenous & obturator. Pierces fascia lata *a little above inner side of knee;* supplies integument of inner sides of thigh & upper part of leg, joining with int. saphenous.

Long or Internal Saphenous Nerve

- The largest branch of anterior division (arises sometimes from posterior division).
Along whole length of outer side of femoral artery, lying first at a slight distance from it, and then close to it.
Pierces fibrous band which extends from vastus internus to tendons of adductors longus & magnus and forms anterior wall of Hunter's canal.
Pierces deep fascia *between tendons of sartorius & gracilis*, and joins with internal cutaneous.
Passes with internal saphenous vein along inner side of leg & divides into two branches; one terminates at inner ankle, the other passes in front of ankle to integument of inner side of foot.
Joins in plexiform network above mentioned with internal cutaneous & obturator nerves; - gives off to integument of front of knee a large branch, nervus cutaneus patellæ, which, joining with external, middle & internal cutaneous nerves & other branches of long saphenous, forms plexus patellæ in front of knee; - gives off numerous branches to integument of front & inner side of leg.

POSTERIOR DIVISION - Gives off:

Muscular Branches

To all the muscles of front of thigh except tensor vaginæ femoris supplied by superior gluteal n., and Sartorius supplied by filaments from middle or sometimes from internal cutaneous nerve. [pectineus is partly supplied by obturator nerve]

Articular Branches

Two: - one from nerve to vastus externus, long & slender & distributed to front of capsule; one from nerve to vastus internus, accompanies deep branch of anastomotica magna to inner side of capsule.

MUSCLES of LOWER LIMB—2nd Tablet.

INTERNAL FEMORAL REGION.

Pectineus – Ilio-pectineal line & surface in front of it.

Upper part of line from trochanter minor to linea aspera, & into femur behind trochanter minor. – S. by obturator or anterior crural nerve; – by accessory obturator nerve when the latter exists.

Gracilis – Inner margin of rami of pubes & ischium & lower half of inner margin of body of pubes.

Upper part of inner surface of shaft of tibia above semitendinosus, and beneath sartorius. – S. by obturator nerve.

Adductor Longus – Front of pubes immediately below the crest & close to angle.

Middle third of inner lip of linea aspera between vastus internus & adductor magnus. – S. by obturator nerve.

Adductor Brevis – Front of pubes for about two inches below adductor longus & between gracilis & obturator externus.

Upper part of linea aspera & lower part of line from it to lesser trochanter below & behind pectineus. – S. by obturator nerve or anterior crural nerve.

Adductor Magnus – Lower part of descending ramus of pubes; ascending ramus & outer side of tuberosity of ischium.

Lower part of line from great trochanter to linea aspera, whole length of inner lip of linea aspera & line from it to inner condyle; by a strong tendon into tubercle at upper & back part of inner condyle. – S. by obturator & great sciatic nerves.

DEEP FEMORAL ARTERY

From outer & back part of femoral one or two inches below Poupart's ligament, and nearly equals superficial femoral in size.

Passes: –

Downwards & outwards in front of iliacus, on outer side of femoral artery;
Downwards & inwards behind femoral vessels & profunda vein, and in front of pectineus:

Backwards between pectineus & adductor longus;
Downwards behind adductor longus, in front of adductors brevis & magnus; –
and ends in a small branch, which perforates lower part of adductor magnus to muscles of back of thigh, and anastomoses with inferior perforating & with branches of popliteal.

BRANCHES:

EXTERNAL CIRCUMFLEX — The larger. From outer side of artery close to its origin.

Outwards between branches of anterior crural nerve and beneath sartorius & rectus, and divides into branches:

ASCENDING – Beneath tensor vaginæ femoris, and anastomose with gluteal & circumflex iliac.

DESCENDING – Usually three or four & of considerable size. – Beneath rectus muscle to vasti, principally the external. One large branch descends with nerve to vastus externus as low as knee, and anastomoses with articular branches of popliteal.

TRANSVERSE – Smaller. Wind round femur below trochanter major in substance of vastus externus, and anastomose with internal circumflex, sciatic & superior perforating.

INTERNAL CIRCUMFLEX — The smaller. From inner & back part close to origin.

Backwards between pectineus & psoas, and winds round inner side of neck of femur to interval between quadratus femoris and adductor magnus, and anastomoses with external circumflex, sciatic & superior perforating. Gives off branches:

ASCENDING – To adductor muscles, gracilis & obturator externus; anastomoses with obturator.

DESCENDING – Between adductors brevis & magnus, which it supplies.

ARTICULAR – Into acetabulum through notch beneath transverse ligament; supplies adipose tissue, and sends twigs along round ligament to head of femur.

PERFORATING — Usually three & of good size. – Arise behind adductor longus, above, in front of, and below, adductor brevis, and pass to back of thigh, the

SUPERIOR, — Perforating the adductor magnus above the brevis (some-perforating adductor brevis also);

MIDDLE, — Perforating both these adductors;

INFERIOR, — Perforating the adductor magnus below the brevis;
and supply hamstring muscles & anastomose with each other, sciatic, internal circmflex & termination of profunda, the middle one, the largest, giving off ascending & descending branches, and nutrient artery of femur.

OBTURATOR NERVE.

Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd (Sappey, Hirschfeldt, & Quain's diagram of lumbar plexus).

Descends through inner fibres of psoas, and emerges from inner border of that muscle opposite brim of pelvis.

Along outer wall of pelvis above obturator vessels to upper part of obturator foramen; enters thigh, and divides into:

Anterior Branch – The smaller. Descends in front of adductor brevis, and behind pectineus & adductor longus, to femoral artery, upon which it is distributed below the latter muscle. Gives off branches: –

ARTICULAR – To hip-joint; arises near obturator foramen.

MUSCULAR – To gracilis & adductor longus, and sometimes to pectineus & adductor brevis;

ANASTOMOTIC TO INTERNAL CUTANEOUS & INTERNAL SAPHENOUS NERVES – Arises opposite lower border of adductor longus, and forms with the foregoing nerves a plexiform network beneath deep fascia of thigh.

Sometimes this anterior branch of the obturator nerve, and its communicating offset to the internal cutaneous & internal saphenous nerves, are larger than usual. The latter then gives off cutaneous filaments to the skin of the lower & inner part of the thigh, and descends along the posterior border of the sartorius to the inner side of the knee-joint; here it pierces the deep fascia, communicates again with the internal saphenous nerve (which is then smaller than usual), and supplies the skin of the inner side of the leg as low as its middle.

Posterior Branch – The larger. Pierces upper fibres of obturator externus, and descends behind adductor brevis in front of adductor magnus; gives off branches: –

MUSCULAR – To obturator externus & adductor magnus (and to adductor brevis, when the latter is not supplied by the anterior branch of the nerve).

ARTICULAR – Through opening in lower part of adductor magnus, and upon the popliteal artery to back of knee-joint.

ACCESSORY OBTURATOR NERVE

Arises (when it exists) either directly from obturator nerve, or, by separate filaments, from the 2nd, 3rd, & 4th lumbar.

Descends along inner side of psoas, crosses front of pubes, gets behind pectineus, and divides into branches to pectineus & hip-joint. Communicates with anterior branch of obturator nerve; the communicating branch is sometimes large, and is then prolonged as a cutaneous nerve to the thigh & leg (Gray)

LOWER LIMB.

II.

FRONT OF LEG & DORSUM OF FOOT.

MUSCLES of LOWER LIMB—3rd Tablet.

ANTERIOR TIBIO-FIBULAR REGION.

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft of tibia; adjoining part of the interosseous membrane; intermuscular septum between it & extensor longus digitorum; deep fascia.
Inner & under surfaces of internal cuneiform bone & base of first metatarsal. – S. by anterior tibial nerve.

Extensor Longus Digitorum – Outer tuberosity of tibia; upper three-fourths of anterior surface of shaft of fibula; interosseous membrane; septa between it and tibialis anticus & peronei muscles; deep fascia.
Bases of 2nd & 3rd phalanges of four outer toes. – S. by anterior tibial nerve.

Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft of fibula internally to extensor longus digitorum; interosseous membrane.
Base of last phalanx of great toe. – S. by anterior tibial nerve.

Peroneus Tertius – Lower fourth of anterior surface of shaft of fibula; lower part of interosseous membrane; intermuscular septum between it & peroneus brevis.
Base of 5th metatarsal bone. – S. by anterior tibial nerve.

FIBULAR REGION.

Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders of fibula; intermuscular septa between it & muscles of front & back of leg; deep fascia.
Outer side of base of first metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

Peroneus Brevis – Lower two-thirds of outer surface of shaft of fibula, passing upwards in a pointed process beneath peroneus longus; intermuscular septa between it & muscles of front & back of leg.
Base of fifth metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

MUSCLES of the FOOT.

DORSAL REGION.

Extensor Brevis Digitorum – Outer & upper surfaces of greater process of os calcis, calcaneo-astragaloid ligament, anterior annular ligament of tarsus.
First phalanx of great toe & outer sides of long extensor tendons of 2nd, 3rd, & 4th toes. – S. by external branch of anterior tibial nerve.

ANTERIOR TIBIAL ARTERY

Anterior & smaller branch of bifurcation of popliteal opposite lower border of popliteus muscle.

Forwards between the two heads of tibialis posticus, and between tibia & fibula through opening in upper part of interosseous ligament.

Downwards in front of interosseous ligament, shaft of tibia & ankle joint (where becomes dorsalis pedis), passing between tibialis anticus & extensor longus digitorum, between tibialis anticus & extensor proprius pollicis, between tendon of extensor proprius pollicis, which crosses it, and innermost tendon of extensor longus digitorum; – lying in a line from inner side of head of fibula to midway between malleoli, and being deeply situated, above, between muscles on either side & beneath tendon of extensor proprius pollicis, and superficially, below, beneath skin, anterior annular ligament & fascia.

Has two venæ comites. Anterior tibial nerve is first external, then anterior, then again external to it.

BRANCHES:

Recurrent tibial — Arises in upper part of leg. Upwards through tibialis anticus to front of knee, and anastomoses with inf. articular branches of popliteal.

Muscular — Numerous small branches to muscles on either side.

Malleolar — Two; rather variable in size. Arise near ankle, and pass, the

INTERNAL, – To inner ankle beneath tendons of extensor proprius pollicis & tibialis anticus,

EXTERNAL, – To outer ankle beneath extensor longus digitorum,

and anastomose respectively with posterior tibial & internal plantar, and with tarsal & peroneal.

DORSALIS PEDIS ARTERY

From bend of ankle to back of first interosseous space, resting upon bones of tarsus between tendon of extensor proprius pollicis & innermost tendon of extensor brevis digitorum, which crosses it near termination, and having anterior tibial nerve on its outer side.

BRANCHES:

Tarsal — Arches outwards beneath extensor brevis digitorum, and anastomoses with metatarsal, external malleolar & external plantar.

Metatarsal — More or less obliquely forwards in front of preceding. Gives off the

THREE OUTER DORSAL INTEROSSEOUS ARTERIES – Along corresponding interosseous spaces. Are joined by anterior & posterior perforating branches, and supply dorsal digital branches to 3½ toes on outer side of foot.

Dorsal Art. of Great Toe — Is the first dorsal interosseous artery, and supplies dorsal digital branches to 1½ toes on inner side of foot.

Communicating — Between the two heads of first dorsal interosseous muscle, and inosculates with external plantar, completing plantar arch. Gives off plantar digital branches to 1½ toes on inner side of foot.

EXTERNAL POPLITEAL NERVE.

The smaller of the two terminal branches of great sciatic.
Along outer side of popliteal space close to biceps.
Pierces peroneus longus an inch below head of fibula, and divides into anterior tibial & musculo-contaneous. Gives off branches: –

Articular – Three; accompany the two external articular & the recurrent tibial arteries to knee-joint.

Cutaneous – Two or three; supply integument of outer & back part of leg; one, the communicans fibularis, crossses outer head of gastrocnemius, and joins the communicans tibialis to form external or short saphenous nerve (V. below).

Anterior Tibial Nerve – Beneath extensor longus digitorum to front of interosseous membrane; along outer side, in front of, and again along outer side of anterior tibial artery to front of ankle-joint. – Supplies muscles of front of leg, and divides into:

External Branch – Beneath extensor brevis digitorum, which it supplies; becomes ganglionic, and supplies articulations of tarsus.

Internal Branch – With dorsalis pedis artery along inner side of dorsum of foot; supplies adjoining sides of great & second toes, and joins with musculo-cutaneous.

Musculo-Cutaneous Nerve – Between peronei muscles, which it supplies, and extensor longus digitorum; pierces deep fascia about lower third of front of leg, and divides into:

Internal Branch – Supplies inner side of great toe, adjoining sides of 2nd & 3rd toes, & integument of inner side of foot; joins with internal saphenous & anterior tibial.

External Branch – Supplies adjoining sides of 3rd, 4th, & 5th toes, and integument of outer side of foot; joins with external or short saphenous.

External Saphenous Nerve—Behind outer malleolus with external saphenous vein, and supplies integument of outer side of foot & little toe; joins with musculo-cutaneous. Is sometimes larger than usual, and then supplies both sides of little toe, and outer side of 4th.

EXTERNAL or SHORT SAPHENOUS VEIN — Commences at outer side of arch on dorsum of foot. Accompanies external or short saphenous nerve behind outer malleolus, along outer border of, & over, tendo Achillis, and between the two heads of gastrocnemius; it then perforates deep fascia at lower part of popliteal space, and opens into the popliteal. It receives numerous branches from back of leg, and communicates with deep veins on dorsum of foot & behind external malleolus. It is provided with two valves, one of which is always found near its termination.

LOWER LIMB.

III.

GLUTEAL REGION, BACK OF THIGH, POPLITEAL SPACE.

MUSCLES of LOWER—4th Tablet.

GLUTEAL REGION.

Gluteus Maximus – Superior curved line on dorsum ilii & rough surface between it & posterior fifth of crest of ilium; sides of lower part of sacrum and coccyx & tendinous expansion over back of sacrum; posterior surface of great sacro-sciatic ligament.

Fascia lata covering outer side of thigh, & rough line from great trochanter to linea aspera. – S. by inferior gluteal nerve.

Gluteus Medius – Dorsum ilii between superior & middle curved lines & outer lip of crest between them; fascia covering anterior part of the muscle.

Oblique line on outer surface of great trochanter. – S. by superior gluteal nerve.

Gluteus Minimus – Dorsum ilii between middle & inferior curved lines.

Anterior border of great trochanter. – S. by superior gluteal nerve.

Pyriformis – By three fleshy digitations from front of sacrum between first, second, third, & fourth anterior sacral foramina & from grooves leading from them; margin of great sacro-sciatic foramen & anterior surface of great sacro-sciatic ligament.

Posterior part of upper border of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Internus – Whole of inner surface of true pelvis in front of and behind obturator foramen; inner surface of obturator membrane & fibrous arch which completes canal for obturator vessels & nerve.

Upper border of great trochanter in front of pyriformis. – S. by one of the muscular branches of sacral plexus.

Gemellus Superior – Outer surface of spine of ischium.

Upper part of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Gemellus Inferior – Upper part of outer lip of tuberosity of ischium.

Lower border of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Quadratus Femoris – Outer border of tuberosity of ischium.

Upper part of linea quadrati on back of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Externus – Inner two-thirds of outer surface of obturator membrane; circumference of obturator foramen, and fibrous arch which completes canal for obturator vessels & nerve.

Digital fossa of femur. – S. by obturator nerve.

GLUTEAL ARTERY.

The largest branch of internal iliac, and the continuation of its posterior division.
Through great sacro-sciatic foramen above pyriformis, and then between latter muscle and gluteus medius, and divides into:
SUPERFICIAL BRANCH – Gives off numerous branches to gluteus maximus & integument over sacrum;
DEEP BRANCH – Forwards between glutei medius & minimus, and divides into:
Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.
Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branch of external circumflex.

SUPERIOR GLUTEAL NERVE.

From back of lumbo-sacral cord.
With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:
SUPERIOR BRANCH – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus
INFERIOR BRANCH – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

SCIATIC ARTERY.

The larger of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.
Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.
Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.
With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus.
Gives off branches:
MUSCULAR, ARTICULAR to hip-joint;
COCCYGEAL, INFERIOR GLUTEAL;
COMES NERVI ISCHIADICI – Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh.

SMALL SCIATIC NERVE.

From lower & back part of sacral plexus.
With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.
Descends beneath gluteus maximus on inner side of great sciatic nerve.
Along back of thigh beneath fascia lata to lower part of popliteal space.
Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve.
Gives off branches:
INFERIOR GLUTEAL – Several, large; to under surface of gluteus maximus.
INFERIOR PUDENDAL – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.
CUTANEOUS – *Descending.* To skin of inner & outer sides of back of thigh, popliteal space and back of leg.
Ascending. Wind round lower border of gluteus maximus to integument over its surface.

MUSCULAR BRS. OF SACRAL PLEXUS.

To pyriformis, obturator internus, gemelli & quadratus femoris.
The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle.
The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint.

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

It gives off: – *Inferior Hæmorrhoidal, Superficial Perinæal, Transverse Perinæal, Artery of the Bulb, & Artery of the Corpus Cavernosum.*

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

MUSCLES of LOWER LIMB—5th Tablet.

POSTERIOR FEMORAL REGION (Hamstring Musceles).

Biceps.

Long Head – In common with semitendinosus from lower & inner of the two surfaces on back part of tuberosity of ischium.

Short Head – Whole length of outer lip of linea aspera between adductor magnus & vastus externus and from inferior external division of linea aspera to within two inches of outer condyle.

Outer side of head of fibula by a strong tendon, which divides into two parts to embrace long external lateral ligament of knee-joint, sends a fibrous prolongation to outer tuberosity of tibia, and gives off an expansion to fascia of leg. – S. by great sciatic nerve.

Semitendinosus – In common with long head of biceps from lower & inner of the two surfaces on back part of tuberosity of ischium.

Upper part of inner surface of shaft of tibia below gracilis & beneath sartorius – S. by great sciatic nerve.

Semimembranosus – Upper and outer of the two surfaces on back part of tuberosity of ischium above & on outer side of origin of biceps & semitendinosus.

By a tendon which divides into three portions, into:

Posterior part of inner tuberosity of tibia, sending an expansion over popliteus;

Groove on inner side of inner tuberosity of tibia beneath internal lateral ligament of knee-joint;

Posterior & upper part of outer condyle of femur, forming chief part of posterior ligament of knee-joint. – S. by great sciatic nerve.

GREAT SCIATIC NERVE.

Arises from the lumbo-sacral cord & the four upper sacral nerves, and is the continuation of the sacral plexus.

Through great sacro-sciatic foramen below pyriformis, on outer side of pudic vessels & nerve.

Downwards between trochanter major & tuber ischii, behind external rotator muscles & adductor magnus, to lower third of back of thigh, where it divides into external & internal popliteal.

Is covered by gluteus maximus & biceps. Gives off branches: –

Articular – To back of hip-joint.

Muscular – To hamstring muscles & adductor magnus.

EXTERNAL POPLITEAL NERVE.

The smaller of the two terminal branches of great sciatic.

Along outer side of popliteal space close to biceps.

Pierces peroneus longus an inch below head of fibula, and divides into anterior tibial & musculo-contaneous. Gives off branches: –

Articular – Three; accompany the two external articular & the recurrent tibial arteries to knee-joint.

Cutaneous – Two or three; supply integument of outer & back part of leg; one, the communicans fibularis, crossses outer head of gastrocnemius, and joins the communicans tibialis to form external or short saphenous nerve (V. next Tablet).

INTERNAL POPLITEAL NERVE.

The larger of the two terminal branches of great sciatic.

Through middle of popliteal space to lower border of popliteus, where it becomes posterior tibial.

Is first superficial & external and at a distance from, then superficial & internal and close to, popliteal vessels. – Its branches are:

Articular – Three; accompany the two internal & the azygos articular arteries to knee-joint.

Muscular – To gastrocnemius, plantaris, popliteus, soleus.

Communicans Tibialis – Between heads of gastrocnemius to middle of back of leg, where it pierces deep fascia and joins communicans fibularis to form the

External Saphenous Nerve – Behind outer malleolus with external saphenous vein, and supplies integument of outer side of foot & little toe; joins with musculo-cutaneous. Is sometimes larger than usual, and then supplies both sides of little toe, and outer side of 4th.

POPLITEAL ARTERY.

Commences at opening in lower part of adductor magnus.
Downwards & outwards to back of knee-joint, and then vertically downwards to lower border of popliteus muscle, where divides into anterior & posterior tibial.

RELATIONS:

In Front – Inner & posterior surfaces of femur, posterior ligament of knee-joint, popliteus muscle.
Behind – Skin & fascia; quantity of fat & lymphatic glands; semimembranosus; gastrocnemius, plantaris, soleus; popliteal vein, internal popliteal nerve.
On Inner Side – Semimembranosus; inner condyle; inner head of gastrocnemius.
On Outer Side – Biceps; outer condyle; outer head of gastrocnemius, plantaris.
Popliteal vein lies close to artery, and is superficial & external to it except at lower part, where it crosses to inner side; it is frequently double at lower part. – Internal popliteal nerve is more superficial & external above, and is superficial & internal below.

BRANCHES:

MUSCULAR:

Superior — Two or three, small, to hamstring muscles & vasti. Anastomose with perforating & articular arteries.
Inferior or Sural — Two, large, to heads of gastrocnemius & plantaris.

CUTANEOUS: — A few, slender; arise separately or with sural. Over gastrocnemius to integument of back of leg.

ARTICULAR — Five:

Superior – Two. Wind round femur above condyles to front of knee, passing, the
Internal, – Beneath tendon of adductor magnus;
External, – Beneath tendon of biceps; and both dividing into
Superficial & deep brs. – to vasti, femur & joint, and anastomosing with each other, and with inferior articular arteries, anastomotica magna & descending branch of external circumflex.

Azygos – Arises behind posterior ligament of knee-joint, which it pierces to supply interarticular ligaments & synovial membrane.

Inferior – Two. Arise beneath gastrocnemius, and wind round head of tibia beneath internal & external lateral ligaments, the external artery passing above head of fibula & beneath tendon of biceps. Divide into numerous branches to front of knee, and anastomose with each other, and with superior articular & the recurrent branch of tibial.

LOWER LIMB.

IV.

BACK OF LEG; SOLE OF FOOT.

POPLITEAL ARTERY

Commences at opening in lower part of adductor magnus.
Downwards & outwards to back of knee-joint, and then vertically downwards to lower border of popliteus muscle, where divides into anterior & posterior tibial.

RELATIONS:

In Front – Inner & posterior surfaces of femur, posterior ligament of knee-joint, popliteus muscle.
Behind – Skin & fascia; quantity of fat & lymphatic glands; semimembranosus; gastrocnemius, plantaris, soleus; popliteal vein, internal popliteal nerve.
On Inner Side – Semimembranosus; inner condyle; inner head of gastrocnemius.
On Outer Side – Biceps; outer condyle; outer head of gastrocnemius, plantaris.
Popliteal vein lies close to artery, and is superficial & external to it except at lower part, where it crosses to inner side; it is frequently double at lower part. – Internal popliteal nerve is more superficial & external above, and is superficial & internal below.

BRANCHES:

MUSCULAR:

Superior — Two or three, small, to hamstring muscles & vasti. Anastomose with perforating & articular arteries.
Inferior or Sural — Two, large, to heads of gastrocnemius & plantaris.

CUTANEOUS: — A few, slender; arise separately or with sural. Over gastrocnemius to integument of back of leg.

ARTICULAR — Five:

Superior – Two. Wind round femur above condyles to front of knee, passing, the
Internal, – Beneath tendon of adductor magnus;
External, – Beneath tendon of biceps; and both dividing into
Superficial & deep brs. – to vasti, femur & joint, and anastomosing with each other, and with inferior articular arteries, anastomotica magna & descending branch of external circumflex.
Azygos – Arises behind posterior ligament of knee-joint, which it pierces to supply interarticular ligaments & synovial membrane.
Inferior – Two. Arise beneath gastrocnemius, and wind round head of tibia beneath internal & external lateral ligaments, the external artery passing above head of fibula & beneath tendon of biceps. Divide into numerous branches to front of knee, and anastomose with each other, and with superior articular & the recurrent branch of tibial.

MUSCLES of LOWER LIMB—6th Tablet.

POSTERIOR TIBIO-FIBULAR REGION.

SUPERFICIAL LAYER.

Gastrocnemius.

INNER HEAD – Depression at upper and back part of inner condyle.

OUTER HEAD – Depression at upper & back part of outer condyle above groove for popliteus. – Both heads also arise from lower part of the two inferior divisions of linea aspera.

By a strong aponeurosis which covers front of the muscle, and contracts into a tendon which joins with that of soleus, into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Soleus – Back of head & upper third of posterior surface of shaft of fibula; middle third of inner border and oblique line on posterior surface of shaft of tibia; tendinous arch between tibial & fibular origins of the muscle beneath which arch pass posterior tibial vessels & nerve.

By a strong aponeurosis which covers posterior surface of the muscle and contracts into a tendon which joins with that of gastrocnemius (Tendo Achillis), into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Plantaris – Lower part of outer division of linea aspera & post. ligament of knee-joint. Joins inner border of tendo Achillis. – S. by internal popliteal nerve.

DEEP LAYER.

Popliteus – Anterior & deepest part of groove on outer side of outer condyle of femur below tubercle for external lateral ligament of knee-joint.

Inner two-thirds of triangular surface on back of upper part of tibia above oblique line. – S. by internal popliteal nerve.

Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft of fibula; lower part of interosseous membrane; intermuscular septum between it & peronei; fascia over tibialis posticus.

Base of the last phalanx of great toe. – S. by posterior tibial nerve.

Flexor Longus Digitorum – Posterior surface of shaft of tibia below oblique line & internally to attachment of tibialis posticus; fascia over tibialis posticus.

Bases of last phalanges of four outer toes. – S. by posterior tibial nerve.

Tibialis Posticus – Posterior surface of shaft of tibia below oblique line & externally to attachment of flexor longus digitorum; nearly whole of posterior surface of interosseous membrane; upper three-fourths of inner surface of shaft of fibula; fascia between it & foregoing muscles.

Tuberosity of scaphoid and internal & external cuneiform bones. – Supplied by posterior tibial nerve.

POSTERIOR TIBIAL ARTERY

Posterior & larger branch of bifurcation of popliteal opposite lower border of popliteus muscle.

Downwards & inwards upon tibialis posticus, flexor longus digitorum, lower end of tibia & ankle joint, being covered by gastrocnemius, soleus and deep layer of fascia in upper two-thirds, and, in lower third, by integument & fascia only on inner side of tendo Achillis.

Divides into the two plantar arteries midway between internal malleolus & heel, and between tendons of tibialis posticus & flexor longus digitorum, which are anterior & internal to it, and tendon of flexor longus pollicis, which lies posterior & external. Posterior tibial nerve is first posterior & internal to it, but soon crosses to its outer side.

BRANCHES:

Peroneal — Arises an inch below lower border of popliteus.

Downwards & outwards upon tibialis posticus & flexor longus pollicis & between fibres of latter muscle, and beneath soleus & deep layer of fascia, and ends on outer side of os calcis, joining with external malleolar & external plantar. Gives off branches:

Muscular – To soleus & muscles of deep layer, and peronei.

Nutrient to Fibula – Downwards in nutrient canal towards lower extremity of the bone.

Communicating to Post. Tibial – Inwards beneath flexor tendons a little above ankle joint.

Ant. Peroneal – The largest branch. Through interosseous membrane two inches above malleoli. Downwards beneath peroneus tertius to outer side of tarsus, and joins with external malleolar & tarsal.

Muscular — To soleus & muscles of deep layer.

Nutrient to Tibia — The largest of the nutrient arteries. – Downwards in nutrient canal towards lower extremity of the bone.

Communicating to Peroneal — Outwards beneath flexor tendons a little above ankle joint.

Internal calcanean — To integument & fat about tendo Achillis & heel.

POSTERIOR TIBIAL NERVE.

Commences at lower border of popliteus.
Beneath arch of soleus, superficial muscles, & deep layer of fascia to interval between inner malleolus & heel, where it divides into internal & external plantar.
Is first internal & posterior to posterior tibial vessels, but soon passes to their outer side. – Its branches are:
Muscular –To flexor longus pollicis, flexor longus digitorum, tibialis posticus.
Plantar Cutaneous – Perforates internal annular ligament to integument of heel & inner part of sole of foot.

MUSCLES of SOLE of FOOT.

FIRST LAYER.

Flexor Brevis Digitorum – Greater tuberosity of os calcis; central part of plantar fascia; intermuscular septa on either side.
Sides of second phalanges of four outer toes. – S. by int. plantar n.

Abductor Pollicis – Greater tuberosity of os calcis; internal annular ligament; intermuscular septum between it and flexor brevis digitorum.
Inner side of base of first phalanx of great toe. – S. by int. plantar n.

Abductor Minimi Digiti – Lesser tuberosity of os calcis, greater tuberosity in front of flexor brevis, and slightly from under surface of os calcis in front of tuberosities; plantar fascia; intermuscular septum between it & flexor brevis.
Outer side of base of first phalanx of little toe. – S. by trunk of external plantar nerve before its bifurcation.

SECOND LAYER.

Flexor Longus Digitorum.

Flexor Accessorius – Inner & under surfaces of os calcis by two heads which embrace the long plantar ligament.
Outer border and upper & under surfaces of tendon of flexor longus digitorum. – S. by trunk of external plantar nerve before its bifurcation.

Lumbricales – Tendons of flexor longus digitorum, the innermost from one, the others from two tendons.
Inner side of extensor tendons & inner side of bases of first phalanges of four outer toes. – S., the two inner ones by internal plantar nerve, the two outer ones by deep branch of external plantar.

Flexor Longus Pollicis.

THIRD LAYER.

Flexor Brevis Pollicis – By a tendinous process from adjoining borders of cuboid & external cuneiform, & from expansion of tendon of tibialis posticus.
Inner & outer sides of base of first phalanx of great toe, a sesamoid bone being developed in each tendon of insertion. – S. by int. plantar n.

Flexor Brevis Minimi Digiti – Base of 5th metatarsal bone & sheath of peroneus longus.
Outer side of base of first phalanx of little toe. – S. by superficial branch of external plantar nerve.

Adductor Pollicis – Bases of 2nd, 3rd, & 4th metatarsal bones & sheath of peroneus longus.
Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

Transversus Pedis – Head of 5th metatarsal bone & transverse ligament of the metatarsus.
Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

FOURTH LAYER.

Plantar Interossei – Three. Arise from lower or plantar half of inner side of shaft of 3rd, 4th, & 5th metatarsal bones, and are inserted into inner side of base of first phalanx of corresponding toes, & into the expansion of the corresponding long extensor tendon. – They adduct the toes towards the second toe. – S. by external plantar nerve.

Dorsal Interossei – Four. Arise from the adjacent sides of two metatarsal bones, as follows: – from the whole extent of the side of the metatarsal bone which corresponds to the toe into which the muscle is inserted inferiorly, from the upper or dorsal half only of the side of the other. They are inserted into the corresponding side of the base of the first phalanx of the toe to which they belong. – They are found on both sides of the 2nd toe and on the outer side of the 3rd & 4th toes. – They abduct therefore the three middle toes from an imaginary line drawn through the second toe. – S. by external plantar nerve.

THE PLANTAR ARTERIES

Branches of bifurcation of posterior tibial beneath internal annular ligament & origin of abductor pollicis.

INTERNAL PLANTAR — The smaller.

Forwards between abductor pollicis & flexor brevis digitorum, and ends at extremity of first metatarsal bone in a small branch which runs along inner border of great toe, and joins with the corresponding plantar digital artery from communicating branch of dorsalis pedis.

EXTERNAL PLANTAR — The larger.

Outwards between flexor brevis digitorum & flexor accessorius, and then forwards between former muscle & abductor minimi digiti as far as base of 5th metatarsal bone.

Round outer border of flexor accessorius, and inwards upon interossei & bases of the metatarsal bones, -beneath adductor pollicis, flexor tendons & lumbricales,- to back of first interosseous space, where inosculates with communicating branch of dorsalis pedis, thus completing plantar arch.

BRANCHES:

Posterior perforating — Three - Through back part of three outer interosseous spaces, and inosculate with dorsal interosseous branches from metatarsal.

Plantar interosseous (DIGITAL) — Four. Forwards upon interosseous spaces (outermost crossing under surface of 5th metatarsal bone under cover of abductor & flexor brevis minimi digiti), and supply plantar digital branches to 3½ toes on outer side of foot. The three innermost give off the

ANT. PERFORATING ARTERIES - Three. Through anterior part of three outer interosseous spaces, and inosculate with the dorsal interosseous branches from metatarsal just before they bifurcate.

THE PLANTAR NERVES.

Internal Plantar Nerve – The larger. With internal plantar artery between abductor pollicis & flexor brevis digitorum, and divides into four digital branches to 3½ toes on inner side of foot. Supplies flexor brevis digitorum, abductor & flexor brevis pollicis, two inner lumbricales, integument of sole of foot & articulations of tarsus; joins with external plantar.

External Plantar Nerve – The smaller. With external plantar artery between flexors accessorius & brevis, and then between flexor brevis & abductor minimi digiti; supplies the first & the last of these muscles, and divides into:

Superficial Branch – Supplies 1½ toes on outer side of foot, flexor brevis minimi digiti & interossei of 4th space; joins with internal plantar.

Deep Branch – Accompanies plantar arch; supplies remaining interossei & lumbricales, adductor pollicis, & transversus pedis.

LOWER LIMB.

V.

MUSCULAR ATTACHMENTS.

ARTICULATIONS.

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—1st T.

The muscules attached to the

INNOMINATE BONE — Are thirty-two in number, and are attached as follows: –

Ilium – Thirteen: –

Gluteus Maximus – Superior curved line on dorsum ilii and rough surface between it & posterior fifth of crest.
Gluteus Medius – Dorsum ilii & outer lip of crest between superior & middle curved lines.
Gluteus Minimus – Dorsum ilii between middle & inferior curved lines.
Rectus Femoris (Reflected Tendon) – Groove above brim of acetabulum.
(Straight Tendon) – Anterior inferior spine.
Iliacus – Iliac fossa & inner lip of crest.
Sartorius – Anterior superior spine & upper half of notch below it.
Tensor Vaginæ Femoris – Anterior superior spine & anterior fifth of outer lip of crest.
Obliquus Externus – Anterior half of outer lip of crest.
Latissimus Dorsi – Posterior half of outer lip of crest.
Internal Oblique – Anterior two-thirds of middle lip of crest.
Transversalis – Anterior three-fourths of inner lip of crest.
Quadratus Lumborum – Posterior part of inner lip of crest for about two or three inches in front of erector spinæ.
Erector Spinæ – Posterior superior spine & posterior fifth of inner lip of crest.

Ischium – Fourteen: –

Gracilis – Inner margin of ascending ramus.
Adductor Magnus – Ascending ramus & outer side of tuberosity.
Obturator Externus – Circumference of obturator foramen.
Transversus Perinæi – Inner & fore part of tuberosity.
Erector Penis or Clitoridis – Pubic arch & fore part of inner side of tuberosity.
Obturator Internus – Whole of inner surface of true pelvis in front of and behind obturator foramen.
Gemellus Superior, *Levator Ani*, *Coccygeus* – Spine.
Gemellus Inferior – Upper part of outer lip of tuberosity.
Quadratus Femoris – Whole length of outer lip of tuberosity.
Biceps (Long Head) – Lower & inner of the two surfaces on back part of tuberosity.
Semitendinosus – Lower & inner of the two surfaces on back part of tuberosity.
Semimembranosus – Upper & outer of the two surfaces on back part of tuberosity.

Pubes – Twelve: –

Pectineus – Ilio-pectineal line & surface in front of it.
Adductor Longus – Front of body immediately below the crest & close to angle.
Adductor Brevis – Front of body for about two inches below adductor longus & between gracilis & obturator externus.
Adductor Magnus – Lower part of descending ramus.
Gracilis – Inner margin of ramus & lower half of inner margin of body.
Obturator Externus – Circumference of obturator foramen.
Obturator Internus – Whole of inner surface of true pelvis in front of & behind obturator foramen.
Rectus abdominis, *Pyramidalis*, *Conjoined Tend. of Int. Oblique & Transv.* – Crest.
Levator Ani – Back of body.

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—2nd T

The muscules attached to the

FEMUR — Are twenty-four in number, and are attached as follows: –

Vastus Externus – Anterior border of great trochanter & horizontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera and line from linea aspera to outer condyle.

Vastus Internus – Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface.

Crureus – Anterior & outer surfaces from anterior intertrochanteric line to within a few inches of condyles.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: – line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner*, *anterior* and *outer* surfaces of shaft of femur.

Subcrureus – Lower part of anterior surface.

Psoas Magnus – Lesser trochanter.

Iliacus – Upper part of line from trochanter minor to linea aspera in front of pectineus.

Pectineus – Upper part of line from trochanter minor to linea aspera, & into the bone behind trochanter minor.

Adductor Longus – Middle third of inner lip of linea aspera between vastus internus & adductor magnus.

Adductor Brevis – Upper part of linea aspera & lower part of line from it to lesser trochanter below & behind pectineus.

Adductor Magnus – Lower part of line from great trochanter to linea aspera, whole length of inner lip of linea aspera & line from it to inner condyle; by a strong tendon into tubercle at upper & back part of inner condyle.

Biceps (Short Head) – Whole length of outer lip of linea aspera between adductor magnus & vastus externus, and from inferior external division of linea aspera to within two inches of outer condyle.

Gluteus Maximus – Rough line from great trochanter to linea aspera.

Gluteus Medius – Oblique line on outer surface of great trochanter.

Gluteus Minimus – Anterior border of great trochanter.

Pyriformis – Posterior part of upper border of great trochanter.

Obturator Internus – Upper border of great trochanter in front of pyriformis.

Gemellus Superior.
Gemellus Inferior. } Indirectly, by joining tendon of foregoing.

Quadratus Femoris – Upper part of linea quadrati on back of great trochanter.

Obturator Externus – Digital fossa.

Gastrocnemius – Depressions at upper and back part of condyles, and lower part of the two inferior divisions of linea aspera.

Plantaris – Lower part of outer division of linea aspera.

Popliteus – Anterior & deepest part of groove on outer side of outer condyle of femur below tubercle for external lateral ligament of knee-joint.

Semimembranosus – Posterior & upper part of outer condyle.

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—3rd T.

The muscular attached to the

TIBIA — Are ten in number, and are attached as follows: –

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft
Extensor Longus Digitorum – Outer tuberosity.
Sartorius – Upper part of inner surface of shaft covering tendons of gracilis & semitendinosus.
Gracilis – Upper part of inner surface of shaft above semitendinosus, and beneath sartorius.
Semitendinosus – Upper part of inner surface of shaft below gracilis & beneath sartorius.
Semimembranosus – Posterior part of inner tuberosity; groove on inner side of inner tuberosity.
Popliteus – Inner two-thirds of triangular surface on back of upper part of shaft.
Soleus – Middle third of inner border, and oblique line on posterior surface of shaft.
Flexor Longus Digitorum – Posterior surface of shaft below oblique line & internally to attachment of tibialis posticus.
Tibialis Posticus – Posterior surface of shaft below oblique line & externally to attachment of flexor longus digitorum.

FIBULA — Are nine in number, and are attached as follows: –

Extensor Longus Digitorum – Upper three-fourths of anterior surface of shaft.
Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft internally to extensor longus digitorum.
Peroneus Tertius – Lower fourth of anterior surface of shaft.
Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders.
Peroneus Brevis – Lower two-thirds of outer surface of shaft, passing upwards in a pointed process beneath peroneus longus.
Biceps – Outer side of head.
Soleus – Back of head & upper third of posterior surface of shaft.
Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft.
Tibialis Posticus – Upper three-fourths of inner surface of shaft.

THE HIP-JOINT.

Is *the* typical enarthrodial articulation.

ARTICULAR SURFACES:

Acetabulum – Deep, hemispherical, further deepened in the fresh condition by the cotyloid & transverse ligaments. Looks downwards, outwards & forwards. Is divided into:

INCOMPLETE ARTICULAR RING – Broadest above & behind, and deficient below & in front.

CENTRAL NON-ARTICULAR DEPRESSION – Continuous with cotyloid notch; lodges a mass of fat, which forms a bed for the round ligament.

Head of Femur – Forms nearly two-thirds of a sphere, and, in the normal position of the limb, looks upwards, inwards & forwards. It presents a little below & behind its centre a small circular depression for attachment of ligamentum teres; near this depression the cartilage is thicker than elsewhere.

LIGAMENTS — Are: –

Capsular – Short & thick, especially above & in front; thinner & looser below & behind; sometimes perforated beneath psoas. – It extends from

Outer lip of margin of acetabulum within two or three lines of the cotyloid ligament, and, opposite the cotyloid notch, from transverse ligament & edge of obturator foramen to *Anterior intertrochanteric line in front; base of neck of femur, above; and, behind, to back of neck of femur, within about half an inch from lesser trochanter & posterior intertrochanteric line.*

Ilio-Femoral or Accessory – A thickened band closely connected with front of capsule, which extends obliquely from

Anterior inferior spine of ilium to
Lower part of anterior intertrochanteric line.

There are also several other accessory bands, viz., one on the outer side of the ilio-femoral termed the *Ilio-trochanteric*, one on the inner side of the ilio-femoral termed the *Pubo-femoral;* also a transverse band at the back of the joint.

Round Ligament or Ligamentum Teres – Interarticular band about an inch long and of very variable strength & thickness, attached, on the one hand, to *Depression a little below & behind centre of head of femur*, and on the other hand, dividing into two fasciculi, to

Margins of cotyloid notch; the two fasciculi blending with the transverse ligament. It conveys a few vessels to head of femur.

Cotyloid – Incomplete fibro-cartilaginous ring triangular on section, presenting a base attached to margin of acetabulum, and a sharp free edge which closely embraces head of femur. It is thickest above & behind, and deficient opposite the cotyloid notch, where it is continued into the transverse ligament. It consists of closely interlaced oblique fibres arising from the different points of the rim of the bone.

Transverse – Strong flattened band, a continuation of the foregoing, which extends from one side of the cotyloid notch to the other, transforming it into a complete foramen.

SYNOVIAL MEMBRANE — Invests whole of anterior surface & greater part of posterior surface of neck of femur, cotyloid ligament, mass of fat at bottom of acetabulum, & ligamentum teres. – It communicates sometimes through a small opening in the capsule with the bursa beneath psoas & iliacus.

VASCULAR & NERVE SUPPLY — From obturator, sciatic & internal circumflex arteries, and from great sciatic, obturator & accessory obturator nerves.

MOVEMENTS — Are flexion, extension, adduction, abduction, rotation & circumduction. –

Flexion is freer then extension: the thigh can be brought forwards till it touches the abdomen, but it cannot be carried backwards to anything like the same extent. Flexion, in fact, is scarcely interfered with by the posterior part of the capsule, which is thin & loose; extension, on the contary, is soon arrested by the ilio-femoral ligament and by the anterior part of the capsule, which is short & thick. –

Of the two lateral movements abduction is the freest; it is checked by the action of the pubo-femoral band. Adduction is checked mainly by the two limbs coming in contact, but also partly by the action of the ilio-trochanteric band. When however flexion & adduction are combined, so that one limb passes in front of the other, the double movement may be carried very far; it is at last arrested, by the action of the round ligament. The round ligament is also tensed when flexion & abduction are combined and carried to a considerable extent, and when the limb is rotated outwards.

Rotation inwards is freer than rotation outwards (rotation being measured from the intermediate position which the foot normally occupies in standing); this is partly due to the greater laxity of the capsule behind than in front, and partly also to the direction forwards both of the head of the femur & of the acetabulum. Rotation takes place round an imaginary line extending from the head of the femur to the centre of the knee-joint. – Circumduction, as all other movements generally, is much less free in the hip than in the sholder-joint.

The weight of the limb at the hip-joint is normally supported by atmospheric pressure: – In consequence of the complete exclusion of air from the joint through the accurate adaptation of the cotyloid & transverse ligaments to the head of the femur, the latter is firmly retained in the acetabulum even after all the soft parts around the joint have been divided; if air be allowed to penetrate into the joint through a perforation of the acetabulum from within, tle limb will immediotely drop.

KNEE-JOINT—3rd Tablet.

LIGAMENTS — Are the: -

Anterior Ligament or Ligamentum Patellæ - Strong flat band about three inches long, a continuation of tendon of rectus femoris, which extends from
Apex of patella & rough depression below its articular surface to
Lower part of tubercle of tibia, being separated from upper part of the tubercle by a small bursa. - It is separated from the synovial membrane of the knee-joint by a considerable mass of adipose tissue.

Posterior Ligament - Consists of three portions (Cruveilhier, Gray) : -

Central Portion or Ligamentum Posticum Winslowii (The only portion described either by Winslow, or by Heath, Quain, & many modern Authors) - Broad flat band partly derived from tendon of semimembranosus, and which extends obliquely from
Back part of inner tuberosity of tibia to
Upper & back part of outer condyle of femur.

Two Lateral Portions (Capsule Fibreuse des Condyles, Cruveilhier) - Closely connected with tendons of gastrocnemius, popliteus, plantaris, and formed chiefly of vertical fibres extending from
Condyles just above their articular surfaces to
Back of head of tibia. - These lateral portions are looked upon by many anatomists as a part of the capsular ligament.

Internal Lateral Ligament - Broad flat band from
Back part of inner tuberosity of femur to
Inner tuberosity & upper part of inner surface of shaft of tibia. - Covers anterior portion of tendon of semimembranosus & inferior internal articular vessels, and is covered by tendons of sartorius, gracilis & semitendinosus, a bursa being interposed.

External Lateral Ligament - Consists of two portions : -

Long External Lateral Ligament - Strong rounded cord from
Back part of outer tuberosity of femur to
Outer part of head of fibula. - It is embraced by the two fasciculi into which the tendon of the biceps divides, and beneath it pass tendon of popliteus & inferior external articular vessels.

Short External Lateral Ligament - Accessory & somewhat variable bundle of fibres intimately blended with capsule, lying behind foregoing & on outer side of tendon of popliteus, and extending from
Lower & back part of outer tuberosity of femur to
Apex of styloid process of fibula.

Capsular Ligament - Lies in contact with the synovial membrane, and beneath the other ligaments, which it binds together. It is strengthened by expansions from the fascia lata and from the vasti, biceps, sartorius & semimembranosus; the expansions from the fascia lata & the vasti forming, on either side of the patella, the so-called *lateral patellar ligaments.* It is attached to
Femur just above the articular surfaces,
Upper border & sides of patella,
Margins of head of tibia & semilunar fibro-cartilages.

Crucial Ligaments - Two, project into the interior of the joint from behind, and cross each other obliquely like the bars of an X.

Anterior Crucial Ligament - The most oblique & somewhat the smaller, from
Inner part of rough triangular depression in front of spine of tibia between points of attachment of anterior extremities of both semilunar fibro-cartilages, and partly also from anterior extremity of the external semilunar fibro-cartilage itself to
Inner & back part of outer condyle of femur.

Posterior Crucial Ligament - The thickest & strongest. Nearly vertically from
Back part of rough depression behind spine of tibia, behind points of attachment of posterior extremities of both semilunar fibro-cartilages, and partly from posterior extremity of external semilunar fibro-cartilage itself to
Anterior & outer part of inner condyle of femur & front of intercondyloid notch.

Transverse & Coronary Ligaments -
Ligamentum Mucosum & Ligamenta Alaria -

THE ANKLE-JOINT.

Is a ginglymoid articulation.

ARTICULAR SURFACES: -

The Trochlea - Is formed by the upper articular surface & the two lateral facets of the astragalus. The upper articular surface is broadest in front, convex from before backwards, & slightly concave from side to side; its outer border is a little longer than the inner one, and is slightly curved inwards posteriorly. Of the two lateral facets, the external one is the largest.

The Receiving Cavity - Is formed by the under surface of the lower extremity of the tibia, and by the outer & inner surfaces respectively of the internal & external malleoli. The under surface of the lower extremity of the tibia is quadrilateral, broadest in front, concave from before backwards, and marked by a slight antero-posterior elevation separating two shallow lateral depressions. Of the articular facets of the two malleoli, that of the outer one is the largest.

LIGAMENTS — Are: -

Anterior & Posterior - Very thin, especially the posterior one, and consisting merely of a few scattered fibres extending between the tibia & the astragalus at the margin of their articular surfaces. - The fibres of the posterior ligament are mainly transverse.

Internal Lateral - Consists of two layers: -

Superficial Layer, or Deltoid Ligament - Strong triangular band, which radiates from
Apex and anterior & posterior borders of internal malleolus to
Inner part of scaphoid & inferior calcaneo-scaphoid ligament; lesser process of os calcis; and back part of inner surface of astragalus.

Deep Layer (Cruveilhier, Gray) - Short thick vertical band from
Apex of internal malleolus to
Inner surface of astragalus below its articular facet.

External Lateral - Consists of three separate fasciculi: -

Anterior Fasciculus - Short, thick, nearly horizontally from
Anterior border of external malleolus to
Astragalus in front of its external articular facet.

Middle Fasciculus - Longer, rounded, from
Apex of external malleolus to
Middle of outer surface of os calcis.

Posterior Fasciculus - The strongest, deeply situated; nearly horizontally from
Depression at inner & back part of external malleolus to
Astragalus behind its external articular facet as far as groove for flexor longus pollicis.

SYNOVIAL MEMBRANE - Communicates with that of the inferior tibio-fibular articulation.

VASCULAR & NERVE SUPPLY — From the malleolar branches of the anterior tibial and the termination of the anterior peroneal, and from the anterior tibial nerve.

MOVEMENTS — Are flexion & extension with a slight amount of lateral mobility in the extended position. - In the flexed position the wide anterior part of the trochlea lies in the narrow posterior part of the receiving cavity, and the posterior fibres of the lateral ligaments are on the stretch; all lateral movement is then impossible. In the extended position the narrow posterior part of the trochlea lies in the wide anterior part of the receiving cavity, and, the lateral ligaments being relaxed (except in forced extension), a considerable amount of lateral movement is permitted: - Adduction is produced by the tibialis anticus, abduction by the peronei. In forced extension, however, the anterior fibres of the lateral ligaments become tensed, and movement from side to side is again prohibited. - Forced extension is accompanied by a slight amount of adduction in consequence of the outer border of the trochlea being a little longer than the inner one and slightly curved inwards posteriorly.

FASCIÆ & SYNOVIAL MEMBRANES of the TARSUS.

FASCIÆ — Are rather ligaments than fasciæ proper, and are therefore described here.

Anterior Annular Ligament – Consists of two portions connected by a thin intervening layer of fascia.

Superior or Vertical Portion – Of considerable breadth & continuous superiorly with deep fascia of leg. It extends from lower part of anterior border of tibia to lower part of anterior border of fibula.

Inferior or Horizontal Portion. – Narrower and continuous anteriorly with deep fascia over dorsum of foot. It extends from upper surface of os calcis, in front of groove for interosseous calcaneo-astragaloid ligament, to internal malleolus & inner border of plantar fascia.

Beneath anterior annular ligament pass from within outwards: –

1. – *Tendon of tibialis anticus* contained throughout in a synovial sheath.
2. – *Tendon of extensor proprius pollicis* contained in a synovial sheath beneath the inferior or horizontal portion of the ligament only.
3. – *Anterior tibial vessels & nerve.*
4. – *Tendons of extensor longus digitorum & peroneus tertius* enclosed throughout in one synovial sheath.

Internal Annular Ligament – Strong fibrous band continuous superiorly with deep fascia of leg, and giving origin inferiorly to innermost fibres of abductor pollicis. It extends obliquely from internal malleolus to inner surface of os calcis. Beneath it pass from before backwards & outwards: –

1. – *Tendon of the tibialis posticus* contained in a synovial sheath.
2. – *Tendon of the flexor longus digitorum* contained in another synovial sheath.
3. – *Posterior tibial vessels & nerve.*
4. – *Tendon of the flexor longus pollicis* also contained in a synovial sheath, and situated at a considerable depth in a groove on posterior surface of astragalus.

External Annular Ligament – Narrower & thinner band extending from external malleolus to outer surface of os calcis, and beneath which pass *Tendons of peronei* both enclosed in one synovial sheath.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Six: –

1. – *Synovial membrane of posterior calcaneo-astragaloid articulation.*
2. – *Synovial membrane common to the anterior calcaneo-astragaloid & astragalo-scaphoid articulations.*
3. – *Synovial membrane of calcaneo-cuboid articulation.*
4. – *General synovial membrane of the tarsus* comprised between the scaphoid & the three cuneiform bones, between the three cuneiform bones, between the external cuneiform bone & the cuboid, between the middle & external cuneiform bones on the one hand and the bases of the 2nd & 3rd metatarsal bones on the other, between the bases of the 2nd & 3rd metatarsal bones. – Sometimes there is a separate synovial membrane between the scaphoid & the cuboid.
5. – *Synovial membrane of the articulation between the cuboid and the 4th & 5th metatarsal bones.*
6. – *Synovial membrane of the articulation between the first cuneiform bone & the first metatarsal.*

Tendinous – Vide Annular Ligaments.

INGUINAL & FEMORAL HERNIÆ,

AND PERINÆUM.

SCARPA'S TRIANGLE—1st Tablet.

Is a broad triangular depression
Situated at upper, inner, & front part of thigh;
Bounded by Poupart's ligament, sartorius & adductor longus;
Continued downwards & inwards into a superficial furrow, which marks position of femoral artery in Hunter's canal.

Its floor is formed from without inwards by iliacus, psoas, pectineus, & small part of adductor brevis.
It contains femoral vessels & anterior crural nerve, and the

PARTS CONCERNED IN FEMORAL HERNIA — These parts are :-

SKIN — Thin, freely movable, more or less studded with hairs at upper & inner part.

SUPERFICIAL FASCIA — Divided into two layers by superficial vessels & nerves & inguinal lymphatic glands.

SUPERFICIAL LAYER - Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions; is rather thinner & less loaded with fat towards lower part of triangle.

DEEP LAYER - Thin & membranous. Adherent superiorly to Poupart's ligament. Stretches over saphenous opening under the name of "*cribriform fascia*," which fascia is perforated by internal saphenous vein & by numerous smaller blood & lymphatic vessels, and is attached firmly to outer margin of the opening, & slightly to the inner margin.

Superficial Vessels & Nerves and Lymphatic Glands - Are the :
Internal saphenous vein ;
Superficial epigastric, superficial circumflex iliac, superficial external pudic arteries with the corresponding veins, which latter open into internal saphenous near its termination;
Ilio-inguinal, crural branch of genito-crural, & external cutaneous nerves.
Lymphatic glands - Form two groups. Those of the
Superior or abdominal group - Are the smaller, and are placed transversely near Poupart's ligament; - they receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock; - those of the
Inferior or femoral group - Are the larger, and are vertically disposed round upper part of saphenous vein ; - they receive the lymphatics of lower limb.

DEEP FASCIA or FASCIA LATA — Dense, fibrous. Presents the saphenous opening, for easier description of which it is usually divided into two portions, the iliac & the pubic.

ILIAC PORTION - The thicker. Attached to crest of ilium, Poupart's ligament & spine of pubes. Is reflected downwards & outwards from this latter point, first bounding the superior angle, or *superior cornu* of the opening, then forming its outer margin. This outer margin is the *falciform process of Burns ;* its upper part is often called *Hey's femoral ligament.* Superiorly this margin overlies the sheath of the femoral vessels. Inferiorly it becomes continuous with pubic portion of the fascia lata by a well defined curved border, which forms the inferior angle, or *inferior cornu* of the opening.

PUBIC PORTION - Much thinner. Is attached to pubic arch at upper and inner part of thigh, and is continuous with iliac portion opposite lower cornu of saphenous opening. From this point it is prolonged upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to ilio-pectineal line.

Saphenous Opening - Is formed therefore by the slitting of the fascia lata & by the folding of the two sides of the slit one over the other. It is oval in shape, broad below, narrow above, 1½ inches long, ½ an inch wide. Its

OUTER BOUNDARY & ITS SUPERIOR ANGLE OR CORNU, - Which are prominent & well defined, are formed by iliac portion of the fascia lata (falciform process & femoral ligament), which portion, as already stated, passes upwards & inwards in front of the femoral sheath, and becomes attached to Poupart's ligament & spine of pubes. - Its

INNER BOUNDARY - Depressed & less clearly defined, is formed by the pubic portion of the fascia lata, which portion, as already stated, passes upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to the ilio-pectineal line. - Its

INFERIOR ANGLE OR CORNU - Is formed by the junction of the iliac & pubic portions of the fascia lata just below opening of internal saphenous vein into the femoral

FEMORAL SHEATH - Vide next Tablet.

SCARPA'S TRIANGLE—2nd Tablet.

FEMORAL SHEATH — Is a thin tube of fascia divided by two delicate septa into three compartments, of which compartments the outermost contains the femoral artery & the crural branch of the genito-crural nerve, the middle one the femoral vein, and the innermost, which is called the femoral canal, some fat & a lymphatic gland.

It is expanded superiorly, where it is continuous beneath Poupart's ligament with the fasciæ of the abdomen, the fascia transversalis & the fascia iliaca passing down to form it, the former in front of, and the latter behind, the femoral vessels.

It is narrow inferiorly, and blends about two inches below Poupart's ligament with the common areolar sheath of the femoral vessels.

Anteriorly it is covered by the iliac portion of the fascia lata (falciform process & femoral ligament), Poupart's ligament, the deep crural arch, and, opposite the saphenous opening, by the cribriform fascia.

Posteriorly it rests upon the pubic portion of the fascia lata & the pectineus muscle.

Its outer wall is vertical, lies in immediate contact with the artery, and is perforated by the crural branch of the genito-crural nerve.

Its inner wall is oblique downwards & outwards from base of Gimbernat's ligament to inner surface of femoral vein. It is pierced superiorly, where it corresponds to the femoral canal, by numerous lymphatic vessels, and, inferiorly, or below the femoral canal, by the internal saphenous vein.

FEMORAL CANAL — Is the innermost compartment of the femoral sheath. Or rather it is the narrow interval comprised, at the upper part of the femoral sheath, between the inner wall of the sheath & the femoral vein; for it can hardly be said to exist as a distinct canal unless the wall of the sheath has been separated from the vein either by dissection or by the pressure of a hernia. – It contains a little fat & a lymphatic gland.

It extends from the femoral ring to the upper part of saphenous opening, and measures from ½ to ¾ an inch in length.

It presents four walls & two openings.

ANTERIOR WALL – Formed by the fascia transversalis, and supported by Poupart's ligament, deep crural arch, & iliac portion of fascia lata (falciform process & femoral ligament);

POSTERIOR WALL – Formed by the fascia iliaca; rests upon pubic portion of fascia lata & pectineus muscle;

INNER WALL – Formed by junction of fasciæ transversalis & iliaca;

OUTER WALL – Formed by the thin septum on inner side of femoral vein;

SUPERIOR OPENING, OR FEMORAL RING – Vide below.

INFERIOR, OR SAPHENOUS OPENING – Vide foregoing Tablet.

Femoral Ring – Is the opening of the femoral canal into the abdomen. – Its boundaries are:–

IN FRONT – Poupart's ligament and the deep crural arch;

BEHIND – Pubes covered by pectineus muscle, & pubic portion of fascia lata;

INTERNALLY – Gimbernat's ligament with the triangular ligament, the conjoined tendon, & the deep crural arch

EXTERNALLY – Femoral vein & the thin septum between it & crural canal.

Its relations are as follows:

Femoral vein, on outer side;

Epigastric artery, crossing upper & outer angle;

Spermatic cord or round ligament, & pubic branch of epigastric above & in front;

Obturator artery, on inner side, in those rare cases in which the artery presents the double abnormality of arising from the epigastric artery, and of arising from that artery at some distance from its root;–the obturator artery then passes first inwards above the ring, and then downwards into the pelvis behind Gimbernat's ligament

It is nearly circular, about ½ an inch wide in the male, a little wider in the female, and is closed by the

SEPTUM CRURALE (J. Cloquet) – A more or less condensed layer of superitoneal areolar tissue adherent to margins of femoral ring, and perforated by numerous apertures for lymphatics. Its upper surface is concave, and separated from the peritoneum by a less condensed layer of the same tissue and sometimes by a lymphatic gland; its under surface is convex & turned towards the femoral canal.

The femoral canal & both its openings are constricted by extension & eversion, and relaxed by flexion & inversion of the thigh.

COVERINGS OF FEMORAL HERNIA — Are:–

FROM WITHIN OUTWARDS : – *Peritoneum, subperitoneal areolar tissue* (a portion of which, thickened & caused to assume a membranous appearance by the pressure of the hernia, was described by Sir A. Cooper under the name of *fascia propria*), *septum crurale, crural sheath, cribriform fascia, superficial fascia, skin.*

FROM WITHOUT INWARDS : – *Skin, superficial fascia, cribriform fascia, crural sheath, septum crurale, subperitoneal areolar tissue, peritoneum.*

The deep seated stricture is to be divided upwards & inwards, in which direction no important vessel is likely to be met with.

PARTS CONCERNED in INGUINAL HERNIA—1st T.

form the inguinal & scrotal regions. From the latter are derived the superficial coverings of large herniæ, which superficial coverings are the same as those of the cord & testis. The former comprises the parts more directly concerned in the occurence of the protrusion, and in the surgical operations thereby required.

SCROTAL REGION — Vide "Coverings of Cord & Testis."

INGUINAL REGION — Bounded by Poupart's ligament, median line, horizontal line through anterior superior spine of ilium. Presents for examination the following strata, between which the inguinal canal is comprised.

Skin – Thin, freely movable, depressed over Poupart's ligament.

Superficial Fascia – Continuous with that of thigh, scrotum (dartos) & perinæum. Divided into superficial & deep layers by the superficial vessels & nerves.

SUPERFICIAL LAYER – Thick, areolar, & more or less distended with fat. Passes over Poupart's ligament without adhering to it.

DEEP LAYER – Thin, membranous, contains no fat; adheres to Poupart's ligament.

SUPERFICIAL VESSELS & NERVES — Are:

Arteries – Superficial epigastric, superficial circumflex iliac, superficial external pudic.

Veins – Corresponding; open into internal saphenous.

Lymphatics – Converge towards the

Superior or Abdominal set of Inguinal Lymphatic Glands – Three or four, small, obliquely disposed along Poupart's ligament; receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock.

Nerves – Ilio-inguinal, & hypogastric branch of ilio-hypogastric.

Aponeurosis of External Oblique – Its fibres are oblique downwards & inwards, and form in succession *Poupart's ligament, Gimbernat's ligament, Outer or Inferior pillar of external abdominal ring, Inner or Superior pillar, Superficial part of Linea Alba* by decussating with their fellows, and perhaps also, after decussating, the *Triangular ligament & the Intercolumnar fibres of opposite side* (Vide Abdominal Aponeuroses). Continuous with this stratum of fibres is the *Intercolumnar or external spermatic fascia*, thin, closely adherent to margin of external abdominal ring, and prolonged downwards into a tubular process around cord and testis.

Lower Part of Internal Oblique – Thin & pale. Its fibres, which arise from outer half of Poupart's ligament, pass *inwards over spermatic cord (or round ligament)*, and then curve *downwards behind it* & behind external abdominal ring & Gimbernat's ligament, covering inner two-thirds of Hesselbach's triangle and forming part of conjoined tendon of internal oblique & transversalis, and, becoming tendinous, are inserted over the extent of about half an inch into crest of pubes in front of rectus and into ilio-pectineal line behind Gimbernat's ligament.

THE CREMASTER MUSCLE – (Vide "Muscles of the Abdomen" & "Coverings of the Testicle") is connected with lowest fibres of internal oblique, and occasionally also with some of the lowest fibres of transversalis.

Lower Part of Transversalis – Also thin & pale. Its fibres, which arise from outer third of Poupart's ligament, take the same course as preceding, and, also becoming tendinous, are inserted with them into crest of pubes and ilio-pectineal line to the extent of about an inch, completing conjoined tendon.

Fascia Transversalis – Part of the general layer of fascia which lines the abdominal & pelvic cavities. In the inguinal region it is thick and dense, and presents the following points of interest:–

AT CIRCUMFERENCE OF INTERNAL ABDOMINAL RING – It is prolonged into a tubular process of membrane, the *infundibuliform fascia*, which descends round the cord & testis, forming the *fascia propria* round the latter.

AT LOWER PART OF REGION – It is,–

In Front of Femoral Vessels – First thickened into an oblique band adherent to Poupart's ligament & termed the *deep crural arch*, and then continued downwards beneath Poupart's ligament in front of the vessels to form anterior wall of femoral sheath.

Externally to Femoral Vessels – Attached to outer part of Poupart's ligament, and continuous with fascia iliaca.

Internally to Femoral Vessels – Attached to crest of pubes & ilio-pectineal line behind conjoined tendon & Gimbernat's ligament.

That part of the fascia transversalis which lies above Poupart's ligament between outer border of rectus muscle & epigastric artery (Hesselbach's triangle) is interesting as being the part which forms a covering to direct inguinal hernia.

Subperitonial Areolar Tissue – More or less distended with fat. Forms a bed in which the epigastric artery passes upwards & inwards along lower & inner boundaries of internal abdominal ring; is continued into a loose sheath round the cord.

Peritoneum – Presents, before the superficial strata of the abdominal wall have been dissected, the two *Inguinal Fossæ, internal & external*, which fossæ correspond respectively to the external & internal abdominal rings, and are separated by an oblique crescentic fold of variable width & prominence, formed by the epigastric & obliterated hypogastric arteries.

PARTS CONCERNED in INGUINAL HERNIA—2nd T.

INGUINAL OR SPERMATIC CANAL

Is an oblique passage 1½ or 2 inches long situated a little above, and parallel to, inner half of Poupart's ligament. It gives passage to the spermatic cord or round ligament, and presents for examination its two openings or rings, and its boundaries or walls.

External Abdominal Ring – Triangular & oblique downwards & inwards, about 1 inch long & ½ inch wide in male but rather smaller in female, bounded laterally by external & internal pillars, above by the intercolumnar fibres, below by the crest of the pubes. Gives off from its margin the intercolumnar or external spermatic fascia, which is prolonged into a tubular process around cord & testis (V. Abdominal Aponeuroses).

Internal Abdominal Ring – A tubular opening in the fascia transversalis formed by the prolongation of this fascia round the cord & testis (infundibuliform fascia, fascia propria), oval with large diameter directed downwards & outwards; situated midway between anterior superior spine of ilium & spine of pubes about ½ an inch above Poupart's ligament; bounded above & externally by the lower arched fibres of internal oblique & transversalis, below & internally by epigastric vessels.

Boundaries or Walls – Formed by:

In Front – Aponeurosis of *external oblique* along whole length; lowest fibres of *internal oblique* along outer third.

Behind – *Fascia transversalis* along whole length; *conjoined tendon* of internal oblique & transversalis, & also *triangular ligament* along inner third.

Above – *Arched fibres of internal oblique & transversalis.*

Below – *Poupart's ligament* blended posteriorly with fascia transversalis.

SURGICAL ANATOMY of INGUINAL HERNIA.

Principal points of interest are the coverings of the hernia, and the relations of the neck of the sac & of the seat of stricture. – For the rest see "Inguinal Hernia" among Tablets on Surgery.

COVERINGS — Differ in the oblique & direct forms, and are slightly modified also in the congenital & infantile varieties of the former, and in the external & internal varieties of the latter. They are as follows:—

OBLIQUE INGUINAL HERNIA

Of the Adult

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, infundibuliform fascia, cremasteric fascia, intercolumnar fascia, superficial fascia, skin.

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, cremasteric fascia, infundibuliform fascia, subserous areolar tissue, peritoneum.

Congenital Variety – Descends directly into tunica vaginalis through pouch of peritoneum which accompanies cord & testis into scrotum, and which has abnormally remained *unclosed.* Its coverings are the same as those of testicle: – *Skin, dartos, intercolumnar fascia, cremasteric fascia, fascia propria, tunica vaginalis reflexa.*

Infantile Variety – Descends into the still patent upper part of the *imperfectly closed* pouch of peritoneum, and becomes more or less completely invested, especially in front, by the posterior part of the tunica vaginalis reflexa. Its coverings are *the same* as those of foregoing variety *with two additional layers of peritoneum*

DIRECT INGUINAL HERNIA

Internal or Common Variety – (Protrudes through inner part of Hesselbach's triangle, on inner side of obliterated hypogastric artery).

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, fascia transversalis (the general f. tr., not the infundibuliform process) *conjoined tendon (or not,* since it is frequently ruptured instead of being pushed forwards) *intercolumnar fascia, superficial fascia, skin.*

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, conjoined tendon (or not), fascia transversalis, subserous areolar tissue peritoneum.

External Variety – (Protrudes through outer part of Hesselbach's triangle, on outer side of obliterated hypogastric artery, & externally to the conjoined tendon) – This exceptional form of inguinal hernia, passes through a considerable portion of the inguinal canal, and greatly resembles the oblique hernia both by presenting a certain degree of obliquity and by having very nearly the same coverings; the covering derived from the cremasteric fascia is alone rather less complete.

RELATIONS OF NECK OF SAC & SEAT OF STRICTURE —

The neck of the sac lies

IN OBLIQUE INGUINAL HERNIA – *On outer side of epigastric artery and in front of spermatic cord,* the elements of which may, however, be more or less scattered round the neck of the sac.

IN DIRECT INGUINAL HERNIA – *On inner side of epigastric artery, in front & slightly on inner side of spermatic cord.*

On account of the uncertainty of the diagnosis between the oblique & direct herniæ it is an accepted rule in surgery to divide a deep seated stricture *directly upwards from middle of upper margin of constricting ring,* that is to say in the direction of the epigastric vessels.

THE ISCHIO-RECTAL REGION.

Corresponds to the portion of outlet of pelvis situated behind a line drawn from front part of one tuber ischii to that of the other. It is bounded in front by above mentioned line; its apex is at point of coccyx; its sides are formed by tuberosities of ischium, great sacro-sciatic ligaments & great glutei muscles.

It contains terminal portion of rectum surrounded by levatores ani and the internal & external sphincters, and on each side of which is the ischio-rectal fossa.

It is triangular in form and depressed centrally towards anus, round which aperture the integument is thrown into numerous folds, and becomes continuous with mucous membrane of intestine.

The skin is dark, but thicker & less movable than on perinæum proper, and contains a few hair-follicles.

The subcutaneous areolar tissue or superficial fascia hardly exists in centre of region, or over sphincter ani, which muscle is closely adherent to integument; but it is abundant laterally, where it is loaded with a large amount of fat, and where it dips into and fills the ischio-rectal fossa.

ISCHIO-RECTAL FOSSA

Is a large excavation which sinks deeply into pelvis on either side of rectum, and which is filled with a considerable amount of loose fatty areolar tissue.

It is wide & triangular at its

Base, – Which corresponds to integument, but it is flattened from side to side and diminished in size superiorly. – Its

Inner Wall – Is oblique downwards & inwards and formed by under surface of levator ani & by sphincter, which muscles are covered by anal fascia.

Outer Wall – Is vertical, and is formed by obturator internus covered by obturator fascia; it presents the pudic vessels & nerve enclosed in a sheath of fascia.

It is bounded:

Above – By junction of anal & obturator fasciæ.

In Front – By junction of the same fasciæ superiorly, and, inferiorly, by junction of the superficial & deep perinæal fasciæ behind transversus perinæi.

Behind – By sacro-sciatic ligaments, coccygeus & the gluteus maximus.

The vessels & nerves it contains are the:

Inferior hæmorrhoidal, in the centre;
Pudic, in the outer wall;
Superficial perinæal, in front;
A branch of 4th sacral nerve, and branches of sciatic artery & small sciatic nerve, behind; the branches of the latter nerve winding round lower border of gluteus maximus.

Above levator ani is the recto-vesical layer of the pelvic fascia (Vide Pelvic F.)

THE MALE PERINÆUM.

Consists of the structures which close outlet of pelvis anteriorly to line drawn from front part of one tuber ischii to that of the other.

It is triangular in form, and is bounded laterally by rami of pubes & ischia and posteriorly by above mentioned line. The width of its base (rather the smallest side of the triangle) is usually about 2¾ inches in the male adult, but it is sometimes considerably reduced; the operation of lateral lithotomy is then greatly impeded.

The part is convex in middle line & slightly depressed laterally, and presents the following layers:

Skin – Thin, dark, freely movable, marked by a prominent median *raphé*, studded with thin crisp hairs, and provided with numerous sebaceous follicles.

Superficial Fascia – Divided into two layers.

SUPERFICIAL LAYER – Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions.

DEEP LAYER – Thin & aponeurotic; lies in close contact with the muscles.

On either side it is attached to rami of pubes & ischia externally to crura penis;

Behind it is connected to central tendinous point of perinæum; and is prolonged beneath sphincter ani, becoming continuous behind transversus perinæi & in front of rectum with inferior layer of deep perinæal fascia;

In front it is unattached, & continuous with dartos;

Superiorly it gives off a median septum, which is rather deficient in front but pretty well marked behind.

It binds down the superficial structures, and bounds inferiorly, and also, through its attachments, laterally & behind, a space, in which if urine be effused, this fluid will be directed forwards towards the scrotum, and the lower part of abdomen, and prevented from passing backwards towards anus, or outwards towards thighs. This layer is sometimes called the *superficial perinæal fascia.*

Superficial Genito-Urinary Muscles – Are the:

ERECTOR PENIS – Covering the crus;

ACCELERATOR URINÆ OR EJACULATOR SEMINIS – Spreading out upon bulb of urethra;

TRANSVERSUS PERINÆI – Separating perinæum proper from ischio-rectal region.

These muscles bound a triangular area, which is crossed superficially by the superficial perinæal vessels & nerve, behind which area passes transversely inwards the transverse perinæal artery, and through which area can be seen deeply the superficial layer of the deep perinæal fascia. In lateral lithotomy the knife is carried backwards & outwards through inner & back part of this area on left side.

Inferior Layer of Deep Perinæal Fascia, or Triangular Ligament of Urethra – Vide below.

Membranous Portion of Urethra, Compressor Urethræ, & Deep Transversus Perinæi, Pudic Vessels & N., Vessels & N. of Bulb, Cowper's Glands & their Ducts – Vide these parts.

Superior Layer of Deep Perinæal Fascia –

The deep perinæal fascia is a complex structure triangular in form, which supports the urethra, and closes anterior part of outlet of pelvis.

On either side it is attached to rami of pubes & ischia internally to crura penis;

Behind it is connected to central tendinous point of perinæum, and is continuous both with thin fascia on under surface of levator ani, and, behind transversus perinæi, with deep layer of superficial fascia of perinæum;

In front it is attached to pubic arch & sub-pubic ligament.

It consists of two aponeurotic layers which are separated in the centre, but united laterally & behind; of these two layers the

ANTERIOR, INFERIOR, OR SUPERFICIAL LAYER – The thickest, is continued downwards & forwards upon anterior part of membranous portion of urethra, and is lost upon the bulb. This layer is perforated by the *urethra* about an inch below symphysis pubis, by *dorsal vein of penis* in front of urethra, & by *pudic vessels & nerve* on either side of the vein; it is the only layer that can properly be called the triangular ligament of the urethra, though the term is sometimes applied to both layers taken together.

POSTERIOR, SUPERIOR, OR DEEP LAYER – Thinner. Is continued upwards & backwards round posterior part of membranous portion of urethra, and becomes continuous with pelvic fascia.

Between these two layers are comprised the parts above mentioned, viz,, *membranous portion of urethra* with *compressor urethræ & deep transversus perinæi muscles, pudic vessels & nerve* with *vessels & nerve of bulb, Cowper's glands & their ducts.*

Above these parts are found in centre of perinæum the

Prostate Gland & Neck of Bladder, – and laterally the

Anterior Part of Levator Ani & of Pelvic Fascia – The latter fascia is continued posteriorly upon posterior part of levator ani, upon rectum & between it & bladder, and belongs as much to ischio-rectal region as to the perinæal.

MUSCLES of the MALE PERINÆUM.

ANAL GROUP.

Sphincter Ani – Tip & back of coccyx and superficial fascia in front of it.
Central tendinous point of perinæum blending with accelerator urinæ, transversus perinæi & levator ani. – S. by inferior hæmorrhoidal branch of pudic, & by anterior division of 4th sacral nerve.

Levator Ani – Back of pubes close to symphysis, spine of ischium, and, between these two points, from a white band or thickening of the pelvic fascia which marks point of division of the latter fascia into obturator & recto-vesical layers.
Side & apex of coccyx, median raphé between coccyx and anus, side of lower part of rectum blending with sphincter ani, and decussates with its fellow in front of rectum and below & behind the prostate forming the so-called levator prostatæ, which latter fasciculus is sometimes separated from the remainder of the muscle by a little areolar tissue. – S. by anterior division of 4th sacral n.

Coccygeus – Spine of ischium & lesser sacro-sciatic ligament.
Side of coccyx and of lower piece of the sacrum. – S. by anterior divisions of 4th & 5th sacral nerves.

Internal Sphincter – Is a thickened circular band of the unstriped muscular fibres of the intestine.

GENITO-URINARY GROUP.

Accelerator Urinæ, Ejaculator Seminis, or Bulbo-cavernous – Central tendinous point of perinæum & median raphé in front of it.
Its posterior fibres are inserted into the triangular ligament; its middle fibres decussate above the bulb & corpus spongiosum which they encircle; its anterior fibres are partly inserted into the corpus cavernosum, and partly joined above it in a tendinous expansion which covers dorsal vessels & nerves of penis. – S. by superficial perinæal nerve.

Erector Penis, or Ischio-cavernous – Inner aspect of tuberosity of ischium behind crus penis and pubic arch on either side, back part of under surface of the crus.
By a tendinous expansion into fore part of under & outer surfaces of crus penis. – S. by superficial perinæal nerve.

Transversus Perinæi – Inner & fore part of tuberosity of ischium.
Central tendinous point of perinæum blending with its fellow, the accelerator urinæ, & sphincter ani. – S. by superficial perinæal nerve.

Compressor, or Constrictor Urethræ – Upper part of pubic arch on either side of symphysis.
Its fibres surround membranous portion of the urethra, decussating above & below it. – S. by pudic nerve.

Deep Transversus Perinæi – Is a thin fasciculus which may or may not be separated from posterior fibres of foregoing muscle. It decussates with its fellow behind the bulb, and covers Cowper's gland.

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

Gives off *Inferior Hæmorrhoidal*, *Superficial Perinæal*, *Transverse Perinæal*, & *Artery of the Bull.*

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

(Vide p. 293).

PARTS CONCERNED in LATERAL LITHOTOMY.

Parts to be divided: -

1. *Integument, superficial fascia, inferior hæmorrhoidal vessels & nerve;*
2. *Posterior fibres of accelerator urinæ & transversus perinæi muscles; probably also the transverse perinæal artery and superficial perinæal vessels & nerves.*
3. *Deep perinæal fascia, left deep transversus perinæi muscle & posterior fibres of compressor urethræ; the anterior fibres of levator ani;*
4. *Membranous & prostatic portions of urethra, and part of prostate gland.*

Parts to be avoided: -

1. *The bulb and its artery* are endangered if incision is begun too far forwards; - if the artery arises further back than usual it is exposed to be divided whatever care be taken;
2. *The rectum* is endangered if incision is begun too far inwards;
3. *The pudic artery*, if incision is carried too far outwards;
4. *Entire breadth of prostate with prostatic veins & accessory pudic artery, if the latter exist*, may be divided if incision into the deep parts is carried too far backwards, and the urine may then become infiltrated between the bladder & rectum.

ABDOMEN.

I.

PERITONEUM &c.

MUSCLES of the ABDOMEN.

External Oblique – Outer surface & lower borders of the *eight lower ribs*, interdigitating by four or five slips with serratus magnus & by three or four with latissimus dorsi.

By fleshy fibres into anterior half of outer lip of crest of ilium, and its aponeurosis forms in succession:

Poupart's ligament;
Gimbernat's ligament;
Outer pillar of external abdominal ring;
Inner pillar of external abdominal ring:
Superficial part of linea alba by decussating with its fellow, and perhaps also after decussating the
Triangular ligament & intercolumnar fascia of opposite side. (Vide abdominal Aponeuroses)

Internal Oblique – Outer half of Poupart's ligament; anterior two-thirds of middle lip of crest of ilium; posterior layer of lumbar fascia.

Lower border of *cartilages of four lower ribs*; linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Transversalis – Outer third of Poupart's ligament; anterior three-fourths of inner lip of crest of the ilium; inner surface of *cartilages of six lower ribs* interdigitating with Diaphragm; by lumbar fascia from tips of spinous processes, tips & bases of transverse processes of all the lumbar vertebræ.

Linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Rectus Abdominis – By two heads from crest of pubes & ligamentous fibres covering symphysis.

Cartilages of 5th, 6th & 7th ribs & side of ensiform cartilage.

This muscle is traversed by from 3 to 5 *lineæ transversæ*, irregular tendinous intersections, which interrupt the superficial fibres and adhere firmly to anterior wall of sheath; these are situated opposite umbilicus, between umbilicus & ensiform cartilage, and, frequently, one or two less complete ones, near or below umbilicus.

Pyramidalis – Front of pubes & anterior pubic ligament.

Linea alba midway between pubes & umbilicus. – Is often absent on one or both sides.

Cremaster – From middle of Poupart's ligament internally to lowest fibres of internal oblique & transversalis, and by a small pointed tendon from front of pubes & sheath of rectus, forming large external, and smaller & less constant internal bundles. Is the everted gubernaculum testis with a few additional fibres of the internal oblique, and sometimes of the transversalis, drawn or pushed down by the testicle during its descent (Curling).

Quadratus Lumborum.

Anterior Portion – Upper border of transverse processes of the two or three lower lumbar vertebræ.

Inner half of lower border of last rib.

Posterior Portion – Ilio-lumbar ligament, and for about 2 or 3 inches from posterior part of inner lip of crest of ilium.

Apices of transverse processes of the 4 upper lumbar vertebræ, and inner half of lower border of last rib,

N.—These muscles are supplied by the lower intercostal, ilio-hypogastric, & ilio-inguinal nerves. The quadratus lumborum also receives branches from the anterior divisions of the lumbar nerves.

PERITONEUM —1st Tablet.

The peritoneum is by far the most extensive & complex serous membrane of the body. To describe it completely it is necessary to trace:

1. – The two sacs separately in the vertical direction & in the middle line;
2. – The two sacs together in the vertical direction;
3. – The greater sac horizontally below the level of the umbilicus;
4. – The two sacs together horizontally above the level of the umbilicus, or through the foramen of Winslow;
5. – The ligaments formed by the peritoneum, and the omenta & mesenteries.

Along the colon & upper part of the rectum the peritoneum is thrown into numerous pendulous processes filled with adipose tissue and termed the appendices epiploicæ.

THE TWO SACS SEPARATELY.

THE GREATER SAC.

Starting from umbilicus the peritoneum passes: –

Over anterior wall of abdomen & diaphragm;
Over upper surface of liver, forming *suspensory or falciform ligament & upper layer of coronary ligament;*
Over under surface of liver to transverse fissure;
To lesser curvature of stomach & first portion of duodenum, forming *anterior layer of lesser or gastro-hepatic omentum,*
Over anterior surface of stomach;
Downwards in front of intestine, forming *anterior layer of great omentum;*
Upwards to transverse colon, forming *posterior layer of great omentum;*
Over under surface of transverse colon;
To spine, forming *inferior layer of transverse meso-colon* & covering under surface of transverse portion of duodenum;

(In the fœtus, also occasionally in the child, and even, though very rarely in the adult, the layer of peritoneum which continues the posterior layer of the great omentum ascends in front of the transverse colon without adhering to it, or adhering to it but slightly, and then passes backwards to the spine *above the transverse meso-colon.* The transverse meso-colon is then formed by the peritoneum *again passing forwards from the spine to the transverse colon,* surrounding the latter, *and for the second time passing backwards to the spine.* The pouch between the transverse meso-colon & the posterior layer of the great omentum subsequently disappears by degrees, adhesions amounting finally to complete fusion of the two layers into one, being established between the two walls of the pouch before adult age is reached).

Along superior mesenteric artery, round small intestine and back to spine, forming *mesentery;*
Downwards in front of spine & Aorta;
Over upper part of rectum, forming *meso-rectum;*
Forwards:

In Male: – To bladder, forming *posterior false ligaments of bladder & recto-vesical pouch;*
In Female: – To vagina & uterus, forming *posterior ligaments of uterus & recto-vaginal pouch*; and then over uterus & from uterus to bladder, forming *anterior ligaments of uterus & utero-vesical pouch;*

Over bladder and from bladder to anterior wall of abdomen;
Up to umbilicus, covering urachus & obliterated hypogastric arteries.

THE LESSER SAC, or SAC of the OMENTUM.

Begins at the foramen of Winslow.

Foramen of Winslow – Is a constriction of the peritoneum bounded by:
In Front – Lesser omentum containing first part of duodenum, hepatic artery, bile duct & portal vein;
Behind – Right crus of diaphragm & inferior vena cava;
Above – Lobus Spigelii of liver (or rather lobus caudatus);
Below – Hepatic artery as it passes forwards from Aorta.

From this point the peritoneum passes: –

Downwards to lesser curvature of stomach, forming *posterior layer of lesser or gastro-hepatic omentum.*
Over posterior surface of stomach;
Downwards in front of intestine and then upwards, forming the *two internal layers of great omentum;*
Over upper surface of transverse colon;
To spine, forming *upper layer of transverse meso-colon;*
Over pancreas;
To under surface of liver, forming *inferior layer of coronary ligament,* and over posterior part of under surface of liver to foramen of Winslow.

PERITONEUM.—2nd Tablet.

The two Sacs traced together in Vertical Direction.

From transverse fissure of liver: –
To lesser curvature of stomach, forming *lesser or gastro-hepatic omentum;*
Separate to surround stomach;
Descend in front of intestine, forming the *two anterior layers of great omentum;*
Ascend to transverse colon, forming the *two posterior layers of great omentum;*
Separate to surround transverse colon;
Backwards to spine, forming *transverse meso-colon;*
Separate:
One descends and forms in succession the mesentery, meso-rectum, recto-vesical pouch (or recto-vaginal & utero-vesical pouches), etc.
The other ascends in front of pancreas and passes over back part of under surface of liver to foramen of Winslow.

(In the fœtus, also occasionally in the child, and even, though very rarely, in the adult, the two posterior layers of the great omentum ascend in front of the transverse colon without adhering to it, or adhering to it but slightly, and then pass backwards together to the spine *above the transverse meso-colon.* Here they separate: – One layer descends, and forms in succession *the transverse meso-colon,* the mesentery, meso-rectum, &c.; the other layer ascends, as above stated, over the pancreas & liver. The pouch between the transverse meso-colon & the great omentum subsequently disappears by degrees, adhesions amounting finally to complete fusion of the two layers into one, being established between the two walls of the pouch before adult age is reached.

Greater Sac traced Horizontally below Level of Umbilicus.

From median line of anterior wall of abdomen: –
To right iliac fossa, where it forms *meso-cæcum* & lower part of *ascending meso-colon;*
Along lateral & posterior walls of abdomen to spine, where it meets superior mesenteric vessels and forms mesentery;
To left iliac fossa, where it forms *sigmoid meso-colon;*
Along lateral & anterior walls of abdomen to median line.

The two sacs traced together Horizontally above Level of Umbilicus or through Foramen of Winslow.

From median line of anterior wall of abdomen: –
Over anterior & lateral walls of abdomen & over right kidney;
Through foramen of Winslow;
Over front of pancreas;
To spleen & then to back of stomach, forming *posterior layer of gastro-splenic omentum;*
Over posterior surface of stomach;
Back to foramen of Winslow, forming *posterior layer of lesser or gastro-hepatic omentum;*
Reflected outwards in front of bile duct, hepatic artery & portal vein, forming *anterior layer of lesser or gastro-hepatic omentum;*
Over front of stomach;
Round spleen & to under surface of diaphragm, forming *anterior layer of gastro-splenic omentum & suspensory ligament of spleen;*
Over left kidney;
Over lateral & anterior walls of abdomen to median line.

PERITONEUM.—3rd Tablet.

LIGAMENTS — Reflexions of peritoneum from walls of the abdomen or pelvis to viscera which are not portions of the intestinal canal.

Belong to liver, bladder, uterus, & spleen.

Ligaments of the Liver – Four:

Suspensory or Falciform Ligament – Triangular or sickle-shaped fold reflected over obliterated umbilical vein or round ligament, and attached to upper surface of liver, diaphragm, & sheath of rectus.

Coronary Ligament – Consists of two layers separated by a considerable interspace, in which interspace the posterior border of the liver is connected to the diaphragm by firm areolar tissue. Its superior layer & the right half of its inferior layer are formed by greater bag; the left half of its inferior layer is formed by lesser bag.

Lateral Ligaments – The two triangular & pointed extremities of coronary ligament. The left one is the longest & most distinct.

Ligaments of the Bladder – Five in number, and termed false ligaments:

Post. False Ligaments – The margins of recto-vesical pouch, in the male, of utero-vesical pouch, in the female. Contain obliterated hypogastric arteries & ureters.

Lateral False Ligaments – From sides of bladder to sides of pelvis.

Sup. False Ligament – Over urachus and obliterated hypogastric arteries to umbilicus.

Ligaments of the Uterus – Six:

Broad Ligaments – From sides of uterus to sides of pelvis. Their free margin contains from before backwards round ligament, Fallopian tube, & ovary.

Ant. & Post. Ligaments – The margins of utero-vesical & recto-vaginal pouches. Obliterated hypogastric arteries & ureters are contained in both these folds.

Suspensory Ligament of the Spleen – Connects upper end of spleen to diaphragm.

OMENTA — Folds proceeding from the stomach to other viscera. Three:

Lesser or Gastro-hepatic Omentum – From transverse fissure of liver to lesser curvature of stomach. – Its right free border contains hepatic artery, bile duct & portal vein, and forms anterior boundary of foramen of Winslow.

Great or Gastro-colic Omentum – Consists of four layers, of which the most anterior & the most posterior belong to greater bag, and the two internal to lesser bag. The two anterior layers descend from great curvature of stomach & spleen; the two posterior ascend to transverse colon (at least in adult; for arrangement in fœtus see foregoing Tablets).

Gastro-splenic Omentum – Connects hilum of spleen to great cul de sac of stomach. Contains splenic vessels & vasa brevia, and is continuous inferiorly with great omentum.

MESENTERIES — Folds connecting greater part of intestine to posterior wall of abdomen. Seven:

Mesentery Proper – Its root extends from left side of 2nd lumbar vertebra to right sacro-iliac synchondrosis. Its free border contains the small intestine. It is continuous superiorly with inferior layer of transverse meso-colon, inferiorly with meso-cæcum & ascending meso-colon.

Meso-cæcum – Usually peritoneum merely passes in front of cæcum; and also merely in front of ascending colon, forming the

Ascending Meso-colon.

Transverse Meso-colon – Formed by junction behind transverse colon of the two ascending layers of the great omentum. Backwards from transverse colon to spine, where it meets transverse portion of duodenum, and becomes continuous with mesentery.

Descending Meso-colon – Similar to ascending meso-colon.

Sigmoid Meso-colon – Broad & well marked fold, which allows of considerable mobility on the part of sigmoid flexure.

Meso-rectum – Surrounds almost completely first portion of rectum, and covers second portion in front & at sides above, in front only towards middle, not at all below.

SUPERIOR MESENTERIC ARTERY.

From front of aorta just below cœliac axis and behind splenic vein & pancreas.
Forwards between pancreas & transverse portion of duodenum, and crosses front of the latter.
Curves downwards to the right between layers of mesentery to right iliac fossa, and inosculates with its own ileo-colic branch.

BRANCHES:

Inferior Pancreatico-duodenal – Given off behind pancreas.
Ascends along concave border of duodenum and joins with superior pancreatico-duodenal.

Vasa intestini tenuis – Ten or twelve or more, and arise from convex side of artery.
Descend between layers of mesentery and divide each of them into two branches, by junction of each of which with the neighbouring branch, a first series of arches is formed, to which 2nd, 3rd, 4th, & even 5th rapidly diminishing tiers succeed, the terminal branches encircling the intestine and ramifying in its coats.

Ileo-colic – The lowest branch from concavity.
Between layers of mesentery towards ileo-colic valve, and divides into:
Ascending Branch – To beginning of colon, and inosculates with colica dextra.
Descending Branch – To end of ileum, and inosculates with termination of superior mesenteric, both branches forming arches as above.

Colica dextra – From middle of concavity.
Beneath peritoneum and in front of right kidney to middle of ascending colon, and divides into
Ascending & Descending Branches, – Which inosculate respectively with the colica media & the ileo-colic, also forming arches as above.

Colica media – From upper part of concavity.
Between layers of transverse meso-colon towards middle of transverse colon, dividing as preceding arteries, and similarly inosculating with colica dextra & colica sinistra.

INFERIOR MESENTERIC ARTERY.

From left side of aorta one or two inches above bifurcation.
Descends along left side of aorta and front of psoas towards left iliac fossa, and then, under the name of superior hæmorrhoidal, curves to the right in front of left common iliac & ureter, and descends into the pelvis behind rectum, between layers of meso-rectum.

BRANCHES:

Colica sinistra – Beneath peritoneum and in front of left kidney to middle of descending colon, and divides into
Ascending & Descending Branches, – Which inosculate respectively with the colica media and the sigmoid artery, and supply intestine as above described.

Sigmoid Artery – Across psoas to sigmoid flexure of colon, and divides into two branches, which inosculate with colica sinistra and sup. hæmorrhoidal.

Superior hæmorrhoidal – The continuation of the inferior mesenteric.
Follows course above described, and divides opposite middle of sacrum into two branches, which descend on each side of rectum to near its lower end, and join with middle hæmorrhoidal.

CŒLIAC AXIS.

Short thick trunk, from front of aorta between pillars of diaphragm.

Forwards above pancreas and between lobus Spigelii & right semilunar ganglion on the right, and left semilunar ganglion & cardiac end of stomach on the left, for about half an inch, and divides into:

GASTRIC, OR CORONARIA VENTRICULI – The smallest.

Upwards and to the left to cardiac orifice of stomach.

Along lesser curvature between layers of lesser or gastro-hepatic omentum to pylorus, where inosculates with pyloric branch of hepatic; gives branches to both surfaces of stomach.

HEPATIC – Intermediate in size in the adult; the largest in the fœtus.

Upwards and to the right in front of foramen of Winslow, between the two layers and along right border of lesser or gastro-hepatic omentum, – ductus communis choledochus lying to the right, and the vena portæ behind, – and divides in transverse fissure of liver into two branches, which accompany divisions of vena portæ & hepatic duct to right & left lobes. Gives off branches:

Pyloric – To pylorus, and along lesser curvature, inosculating with gastric.

Gastro-duodenalis – Large; downwards behind duodenum, and divides into:

GASTRO-EPIPLOICA DEXTRA – Along greater curvature of stomach between layers of great omentum, giving branches to both surfaces of stomach and to omentum, and inosculates with gastro-epiploica sinistra.

PANCREATICO-DUODENALIS SUPERIOR – Descends between pancreas and duodenum and anastomoses with inferior pancreatico-duodenalis, a branch of superior mesenteric.

Cystic – Arises from right division. – Upwards to neck of gall bladder, and ramifies on its under surface, and between it & liver.

SPLENIC – The largest.

Tortuous course to the left behind upper border of pancreas and above splenic vein, and divides into numerous branches which enter hilum of spleen. – Gives off:

Pancreaticæ parvæ – Numerous, small.

Pancreatica magna – From left to right along posterior surface of pancreas.

Vasa brevia – From five to seven in number; between layers of gastro-splenic omentum to splenic end of stomach.

Gastro-epiploica sinistra – Along greater curvature of stomach between layers of great omentum, giving branches to both surfaces of stomach & to omentum, and inosculating with gastro-epiploica dextra.

THE STOMACH.

Is situated in the left hypochondriac, epigastric, & part of right hypochondriac regions, and presents:

Ant. Surface – Looks upwards & forwards, and is in contact with under surface of liver, diaphragm, and anterior wall of abdomen opposite *pit of stomach.*

Post. Surface – Directed downwards & backwards, and covered with peritoneum of lesser sac, by which sac it is separated from pancreas, great vessels of abdomen, crura of diaphragm & solar plexus. Rests upon transverse meso-colon.

Great or Splenic End, Great Cul-de-sac or Fundus – Lies beneath the six lower left ribs, in contact with the spleen to which it is connected by the gastro-splenic omentum.

Lesser or Pyloric End – In contact with anterior wall of abdomen, under surface of liver, & neck of gall-bladder.

Greater Curvature – Lies above transverse colon, and gives attachment to great omentum.

Lesser Curvature – Connected to transverse fissure of liver by lesser or gastro-hepatic omentum, and to under surface of diaphragm by gastro-phrenic ligament.

Œsophageal or Cardiac Opening – Funnel-shaped, and situated above & behind the pyloric opening.

Pyloric Opening – Guarded by pylorus, and is more movable than the œsophageal.

When the stomach is distended its greater curvature is elevated & carried forwards, while its anterior surface is turned upwards, and its posterior surface downwards.

THE SMALL INTESTINE.

Is a slightly narrowing convoluted tube about 20 feet long, connected to the spine by the mesentery in the greatest part of its extent.

It is divided into:

DUODENUM — Vide below.

SMALL INTESTINE PROPER — Is rather arbitrarily divided, no defined limit existing, into:

JEJUNUM — The upper two fifths. Wider, thicker, & more vascular, and has its villi & valvulæ conniventes more, and its Payer's patches less, numerous & developed.

ILEUM — The lower three-fifths. Narrower, thinner, & less vascular, and has its villi & its valvulæ conniventes less, and its Payer's patches more, numerous & developed.

THE DUODENUM

Is the shortest, widest & thickest part of the small intestine, and has no mesentery. Its length is from 8 to 10 inches, or about twelve finger breadths. – Into it open by a common orifice the common bile & pancreatic ducts, and the villi & valvulæ conniventes are larger & more numerous immediately below this opening than in any other part of the small intestine. – Its course is:

Upwards & to the right to under surface of liver & neck of gall-bladder:
Downwards in front of right kidney;
Transversely to the left to left side of 2nd lumbar vertebra, where it is crossed by superior mesenteric artery, and where mesentery begins.

RELATIONS:

First, or Ascending Portion –

ABOVE – Under surface of liver & neck of gall-bladder;
BEHIND – Right border of lesser omentum, hepatic artery, bile duct, portal vein.

Second, or Descending Portion –

IN FRONT – Hepatic flexure of colon;
BEHIND – Right kidney;
ON INNER SIDE – Head of pancreas, ductus communis choledochus, pancreatico-duodenal arteries.

Third, or Transverse Portion –

IN FRONT – Descending layer of transverse meso-colon, superior mesenteric vessels.
BEHIND – Aorta, inferior vena cava, crura of diaphragm;
ABOVE – Lower border of pancreas, superior mesenteric vessels.

THE LARGE INTESTINE.

About 5 feet long, sacculated. Diminishes in size till just above anus, where it is considerably enlarged.

Consists of *cæcum*, *ascending*, *transverse*, & *descending colon*, *sigmoid flexure* & *rectum*.

CÆCUM or CAPUT CÆCUM COLI — The cul-de-sac situated below entrance of small intestine into the large; is the most dilated part of colon.

Lies in right iliac fossa, where it is retained by the peritoneum which covers its front & sides, and sometimes surrounds it entirely in a distinct fold, the meso-cæcum.

Presents:

Appendix Vermiformis - A tubular prolongation from 2 to 6 inches long & of about the diameter of a goose-quill connected with lower & back part of cæcum; usually directed upwards & inwards behind it, and retained by a fold of peritoneum.

Ilio-Cæcal or Ilio-Colic Valve, or Valve of Bauhin - Situated at entrance of small intestine into the large at upper inner & back part of cæcum.

Formed by two crescentic folds of the mucous & submucous coats & circular muscular fibres of the gut, which folds are separated by a narrow antero-posterior aperture.

The upper fold is nearly horizontal, and is the smallest.

The lower fold is oblique, and is the largest.

At their points of coalescence they are continued upon wall of gut into two prominent folds, the *frænа*.

Their surface turned towards the small intestine is covered with villi, the other surface has no villi, and is quite smooth.

ASCENDING COLON —

Upwards to under surface of liver on right side of gall-bladder, where it curves to the left, forming *hepatic flexure*.

Bound down against quadratus lumborum & right kidney by peritoneum which covers its front & sides, and sometimes encloses it in a distinct fold, the ascending meso-colon.

TRANSVERSE COLON or ARCH of the COLON —

Curves forwards & to the left between confines of umbilical & epigastric regions to left hypochondrium, where it bends downwards, forming *splenic flexure*. Is very movable, being comprised between the two ascending layers of great omentum, which layers join again behind it to form transverse meso-colon.

Its relations are:

Above – Liver, gall-bladder, great curvature of stomach, lower end of spleen;

In Front – Great omentum, anterior wall of abdomen;

Behind – Transverse meso-colon, 3rd portion of duodenum.

DESCENDING COLON —

Downwards in front of left crus of diaphragm, left kidney & quadratus lumborum to left iliac fossa, where it ends in sigmoid flexure. Covered by peritoneum in front & at sides, sometimes entirely surrounded by a distinct fold, the descending meso-colon.

SIGMOID FLEXURE —

Commences at crest of ilium, ascends to right or left, descends, and ends in rectum opposite left sacro-iliac synchondrosis. Freely movable, being retained by only a loose fold of peritoneum, the sigmoid meso-colon.

THE PANCREAS.

Lies behind stomach & lesser bag of peritoneum opposite first lumbar vertebra. It is long, narrow, flattened from before backwards, & of a reddish cream-colour, and presents:

Head, or Right Enlarged Extremity – Curves downwards, and is embraced by concavity of duodenum, the ductus communis choledochus & the pancreatico-duodenal arteries lying between the two organs, the former behind, the latter in front. – The lower & back part of the head (sometimes detached from the remainder of the gland, and then called the *lesser pancreas)*, passes to the left behind superior mesenteric vessels, forming the posterior wall of an incomplete canal in which these vessels are enclosed.

Body, or Central Flattened Portion – Presents:

Anterior Surface – Convex, covered by peritoneum belonging to lesser bag, & by posterior surface of stomach.

Posterior Surface – Concave; in relation with:

Pillars of diaphragm, left quadratus lumborum, left kidney & left suprarenal capsule;

Aorta, vena cava, mesenteric vessels, commencement of vena portæ, & left renal vessels.

Upper Border – Thick, corresponds to cœliac axis, and is deeply grooved for splenic artery & vein.

Lower Border – Thinner, separated from transverse portion of duodenum by superior mesenteric vessels.

Lesser End, or Tail – Lies a little higher than the head, in contact with left kidney & left suprarenal capsule, & lower & back part of spleen, to which latter organ it is slightly adherent.

PANCREATIC DUCT, or CANAL OF WIRSUNG — Runs from left to right through whole length of the gland, lying in the vicinity of its anterior surface & lower border. In the head it curves downwards on left side of ductus communis choledochus. Both ducts then perforate together the muscular coat of the intestine, run side by side for about three-quarters of an inch beneath mucous membrane, and open by a common orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. The duct from the lesser pancreas opens into canal of Wirsung near its termination, or, sometimes, forms a supplementary canal which opens separately into duodenum an inch or more above canal of Wirsung.

STRUCTURE — The pancreas is a racemose or conglomerate gland and is very similar to the salivary glands, excepting that its tissue is somewhat softer & looser.

Vessels & Nerves – *Arteries* from the splenic and superior & inferior pancreatico-duodenal. – *Veins* open into the splenic & mesenteric. – *Lymphatics* open into the lumbar glands. – *Nerves* are from solar plexus.

THE SPLEEN.

Is compressed & oval in form, soft, brittle, & of a dark reddish-blue colour, and lies in left hypochondrium, embracing cardiac end of stomach, to which it is connected by gastro-splenic omentum. It presents:

Outer Surface – Convex, in relation with under surface of diaphragm; corresponds to 9th, 10th, & 11th ribs.

Inner Surface – Concave. Presents a little behind its middle the hilum, a vertical fissure pierced by several irregular foramina for the blood-vessels, lymphatics & nerves, and is related with:

In Front – Great cul-de-sac of stomach;
Behind – Left crus of diaphragm, left suprarenal capsule & usually a process of lesser sac of peritoneum;
Below – Tail of pancreas.

Upper Extremity – Thick, rounded, attached to diaphragm by suspensory ligament.

Lower Extremity – Pointed, in relation with splenic flexure of colon.

Anterior Border – Thin, frequently notched.

Posterior Border – Thick, rounded, lies on left kidney.

THE EXTERNAL BILE DUCTS.

Hepatic Duct – Formed in transverse fissure by junction of the two large excretory ducts from right & left lobes

Downwards & to the right between the two layers of lesser or gastro-hepatic omentum & behind first portion of duodenum, having hepatic artery on the left & vena portæ behind, and joins with cystic duct to form ductus communis choledochus. Is about an inch & a half long, and is intermediate in size between cystic duct & ductus communis choledochus.

GALL-BLADDER — Pear-shaped, three or four inches long, an inch wide at largest part; holds from 8 to 12 drachms. Obliquely directed downwards, forwards, & to the right, & lies in a fissure or fossa on under surface of liver between lobus quadratus & right lobe proper. Presents:

Under Surface – Covered by peritoneum, which in most cases merely passes over it; in relation with hepatic flexure of colon & first part of duodenum; sometimes with pyloric end of stomach. – Occasionally the peritoneum entirely surrounds the gall-bladder, which latter is then connected to the liver by a small mesentery.

Upper Surface – Connected to the liver by firm areolar tissue & vessels; sometimes by a small mesentery.

Anterior Enlarged Extremity, or Fundus – Covered by peritoneum; touches abdominal parietes opposite tip of 10th costal cartilage.

Posterior Constricted Extremity, or Neck – Forms two turns upon itself like an italic *f*, and is continued into the cystic duct.

Cystic Duct – Downwards & to the left between the two layers & along the right border of lesser or gastro-hepatic omentum and behind ascending portion of duodenum, having the cystic artery on the left & the vena portæ behind, and joins with hepatic duct to form ductus communis choledochus. Is about an inch long, and is rather narrower than the hepatic duct.

Ductus Communis Choledochus – Downwards & slightly to the left between the two layers & along the right border of lesser or gastro-hepatic omentum, having hepatic artery on the left & vena portæ behind.

Between head of pancreas & descending portion of duodenum on right side of pancreatic duct, and with pancreatico-duodenal arteries which lie slightly in front.

Perforates muscular coat of intestine in common with the latter duct. Both ducts then run together for about three-quarters of an inch between coats of intestine, and, becoming slightly constricted, open by a common & prominent orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. – The common bile duct is about three inches long.

THE LIVER.

The largest gland in the body, of a dull reddish brown colour, situated in right hypochondriac, epigastric & part of left hypochondriac regions. – Its transverse & antero-posterior diameters, and its greatest thickness are usually about twelve, six, & three inches respectively. It weighs from three to four pounds. – Presents:

UPPER SURFACE — Smooth, convex, divided into right, largest, & most convex lobe, and left lobe, smaller & flatter, by suspensory or falciform ligament. In relation with under surface of diaphragm, & the six or seven lower ribs, and to a slight extent in the upright posture & during deep inspirations, especially in women & children, with anterior wall of abdomen.

UNDER SURFACE — Vide next Tablet.

ANTERIOR BORDER — Thin, inclined downwards & to the right, notched deeply opposite round & falciform ligaments, and usually more slightly so opposite fundus of gall-bladder. In recumbent posture & during expiration it usually corresponds to lower border of ribs & costal cartilages, in upright posture & during deep inspirations, especially in women & children, it descends a little lower.

POSTERIOR BORDER — Thick & rounded, especially to the right, in relation with pillars & under surface of diaphragm, to which it is connected by coronary ligament; and with aorta & inferior vena cava, for passage of which latter vessel it is deeply grooved & sometimes channelled.

RIGHT EXTREMITY — Thick & rounded, attached to diaphragm by right lateral ligament; descends lower than the left.

LEFT EXTREMITY — Thin & flattened, attached to diaphragm by left lateral ligament; ascends higher than the right.

LIGAMENTS OF THE LIVER — Five in number:

Round Ligament – The obliterated remains of umbilical vein & ductus venosus. Ascends in free margin of falciform ligament from umbilicus to longitudinal fissure on under surface of liver, where it joins inferior vena cava.

Falciform or Suspensory Ligament
Coronary Ligament . . . .
Lateral or Triangular Ligaments .
} Formed by peritoneum. – Vide Peritoneum.

UNDER SURFACE of the LIVER.

Concave uneven, looks downwards & backwards, and covers stomach, duodenum, hepatic flexure of colon, right kidney & right suprarenal capsule.
Presents four fissures, one of which is divided into two, and two primary lobes, of which the right one, or right lobe proper, presents three sub-lobes or lobules.

FISSURES — Are the:

Longitudinal Fissure – Separates right & left lobes, and extends from deep notch on anterior border as far backwards as posterior border. It is divided into:

UMBILICAL FISSURE – Its anterior & deepest two-thirds, situated in front of transverse fissure; contains umbilical vein in the fœtus, and its obliterated remains in the adult. Is often bridged over posteriorly by a band of liver substance, the pons hepaticus.

FISSURE FOR THE DUCTUS VENOSUS – Its posterior & shallowest third; contains the ductus venosus in the fœtus, & its obliterated remains in the adult.

Transverse Fissure – Extends transversely to the right from longitudinal fissure for about two inches, lying nearer to posterior than to anterior border. – It transmits hepatic artery, bile duct, portal vein, lymphatics & nerves, the hepatic artery lying to the left & in front, the bile duct to the right & in front, and the portal vein behind.

Fissure or Fossa of the Gall-Bladder – Shallow, broadest in front, nearly parallel to longitudinal fissure on right side of which it is situated, and extends from anterior border to near right extremity of transverse fissure.

Fissure for the Inf. Vena Cava – Extends from behind lobus caudatus to posterior border of liver, where it joins with fissure for ductus venosus. Is often transformed into a complete foramen, by a prolongation of the lobus Spigelii. It gives exit to the hepatic veins which here open into the inferior cava.

LOBES — Are the:

Right Lobe – The largest. Presents the three last named fissures, and also, further to the right, the *impressio colica* for hepatic flexure of colon, behind which is the *impressio renalis* for right kidney & right suprarenal capsule. – It also presents the three following sub-lobes:

LOBUS QUADRATUS – Situated in front of transverse fissure, between fissure for the gall-bladder & umbilical fissure; quadrilateral & broadest from before backwards.

LOBUS SPIGELII – Situated behind transverse fissure, between fissure for ductus venosus, & fissure for inferior vena cava; more prominent than former, but less regular in shape. Projects into lesser sac of peritoneum.

LOBUS CAUDATUS – A prominent ridge extending from front part of lobus Spigelii to under surface of right lobe proper; forms anterior boundary of fissure for inferior vena cava & upper boundary of foramen of Winslow.

Left Lobe – Is smaller than the right. Its under surface rests upon the stomach, and sometimes extends as far as upper border of spleen.

PORTAL SYSTEM.

PORTAL TRUNK — Formed by junction of splenic & superior mesenteric veins behind upper border of head of pancreas.

Upwards & to the right in right or free border of lesser or gastro-hepatic omentum, lying between & behind hepatic artery & bile duct, in front of foramen of Winslow. Expands near right extremity of transverse fissure of liver into the *sinus of the portal vein*, and divides into right branch, the larger & shorter, and left branch, the smaller & longer; which branches ramify in portal canals with branches of hepatic artery, bile ducts, deep lymphatics, & nerves. (For distribution of portal vein in the liver and its continuation into the hepatic veins, vide Structure of Liver). – Receives veins:

Gastric & Cystic – The former runs from cardia to pylorus; the latter frequently opens into right branch of portal vein.

Splenic Vein – Arises by five or six branches of considerable size, which emerge from hilum of spleen and join to form one large trunk, which trunk takes a straight course from left to right behind upper border of pancreas, below splenic artery, and, at upper border of right extremity or head of pancreas, joins with superior mesenteric to form the portal trunk. Receives veins:

Inferior Mesenteric (Vide below), *Vasa Brevia, Left Gastro-Epiploic, Pancreatic & Pancreatico-Duodenal.*

Superior Mesenteric Vein – Arises from area of distribution of superior mesenteric artery, (small intestine, cœcum, ascending portion & right half of transverse portion of colon), its branches corresponding to those of the artery. Its trunk lies to the right & a little in front of the artery, and passes with it in front of transverse portion of duodenum & behind pancreas, and, at upper border of head of pancreas, joins with splenic vein to form the portal trunk.

Inferior Mesenteric Vein – Arises from area of distribution of inferior mesenteric artery (upper part of rectum, sigmoid flexure, descending portion & left half of transverse portion of colon), – its superior hæmorrhoidal branch anastomosing with the middle & inferior hæmorrhoidal branches of the internal iliac & pudic, and thus establishing an important communication between the portal & general venous systems, which communication is supplemented, according to Kiernan, by communications between the right renal vein & the veins of the ascending colon & duodenum, and by communications in the coronary ligament of the liver between the phrenic & the superficial branches of the portal vein. Ascends beneath peritoneum and behind transverse portion of duodenum & pancreas, and opens into splenic.

The portal system contains no valves.

ASCENDING VENOUS TRUNKS.

COMMON ILIAC VEINS — Formed by junction of external & internal iliacs opposite sacro-vertebral articulation (some authors say opposite sacro-iliac synchondrosis). Obliquely upwards, the left one more obliquely than the right, to a little to the right side of intervertebral disc between 4th & 5th lumbar vertebræ, where they unite to form the inferior cava.

RIGHT COMMON ILIAC — Shorter & less oblique than the left one; lies at first behind & then on outer side of its artery. Receives

Tributary Branches: - *Ilio-Lumbar*, & sometimes *Lateral Sacral.*

LEFT COMMON ILIAC — Longer & more oblique than the right one; lies at first on inner side of its artery, and then passes behind artery of right side. Receives

Tributary Branches: - *Ilio-Lumbar*, & sometimes the *Lateral* & *Middle Sacral.* - The common iliac veins have no valves.

INFERIOR VENA CAVA — Formed by junction of the two common iliacs a little to the right side of intervertebral disc between 4th & 5th lumbar vertebræ.

Along right side of aorta in front of right lumbar & renal arteries & right crus of diaphragm, passing in succession behind attached border of mesentery, transverse portion of duodenum, pancreas, & portal trunk.

Through groove or canal in posterior border of liver, where the hepatic veins open into it.

Perforates central or cordiform tendon of diaphragm between its middle & right leaflets.

Enters fibrous bag of pericardium, becomes invested anteriorly by serous layer of same sac, and opens into lower & back part of right auricle near interauricular septum, its opening being guarded by the Eustachian valve. Receives

Tributary Branches: - *Middle Sacral, Lumbar, Renal, Hepatic, Right Spermatic, Suprarenal,* & *Inferior Phrenic,* the middle sacral sometimes opening into the left common iliac.

ABDOMINAL AORTA.

Curves slightly backwards & to the left from aortic opening in front of 12th dorsal vertebra to a little to the left of 4th lumbar vertebra, where it divides into the two common iliacs.

RELATIONS:

In Front – Lesser omentum, stomach, cœliac axis, solar plexus;
Splenic vein, pancreas, left renal vein;
Transverse portion of duodenum, mesentery, aortic plexus.

Behind – Vertebræ, left lumbar veins, receptaculum chyli, thoracic duct.

To the Right – Inferior vena cava, vena azygos major, receptaculum chyli, thoracic duct, right semilunar ganglion.

To the Left – Cord of sympathetic, left semilunar ganglion.

**BRANCHES — Phrenic, Cœliac Axis, Superior Mesenteric;
Suprarenal, Renal, Spermatic;
Inferior Mesenteric, Lumbar, & Sacra-Media.**

BRANCHES of the ABDOMINAL AORTA.

Inferior Phrenic – Two. Arise separately or by a common trunk either from cœliac axis, or from aorta immediately above the latter.
Upwards and outwards behind œsophagus on left side, behind vena cava on right side, to central tendon of diaphragm, and divide into:
INTERNAL BRANCH – To front part of diaphragm communicating with its fellow & with musculo-phrenic
EXTERNAL BRANCH – To side of thorax, communicating with intercostals.
Gives off small *superior capsular branches* to suprarenal capsule.

Cœliac Axis – Vide p. 115.

Superior Mesenteric – Vide p. 114.

Suprarenal – Two. Small in adult, but in fœtus as large as renal. To suprarenal capsules, anastomosing with capsular branches of phrenic & renal.

Renal or Emulgent – Two. Large, from sides of aorta just below superior mesenteric.
Nearly horizontally outwards behind renal vein, and divide, each of them, into four or five branches, which penetrate into hilum of kidney in front of pelvis. – Give off small *inferior capsular branches* to suprarenal capsule, and twigs to pelvis & ureter.
Right artery passes behind inf. vena cava, is longer than left one, and lies a little lower.
Renal arteries vary considerably in coincidence with variations of kidneys in situation, size, and number. – They may arise from front of aorta near its bifurcation, or from common or internal iliac; – they may divide into branches sooner than usual, or may be replaced by several arteries which arise separately from side of aorta; – one may be wanting, or there may be a supernumerary artery corresponding to a supernumerary kidney.

Spermatic – Two; long & slender. From front of aorta a little below renal.
Downwards and outwards beneath peritoneum to brim of pelvis crossing psoas & ureter and, on right side, inferior vena cava.
Forwards in front of external iliac artery to internal abdominal ring, being crossed on right side by termination of ileum, on left side by sigmoid flexure of colon.
Through inguinal canal and down to back of testis with other constituents of spermatic cord, becoming tortuous near its termination, and giving twigs to epididymis, which twigs join with artery of vas deferens; pierces tunica albuginea to substance of testis.
OVARIAN ARTERY – In female. Same course down to brim of pelvis, then passes downwards & inwards to attached margin of ovary between layers of broad ligament of uterus; joins with uterine on side of uterus; gives branches to Fallopian tube and twigs to round ligament, which twigs are sometimes continued through inguinal canal to integument of labium & groin.
Both these arteries are short during first part of fœtal life, when testes & ovaries lie just below kidneys, and become elongated only when these organs descend into pelvis.

Inferior Mesenteric – Vide p. 144.

Lumbar – Usually four; from back of aorta.
Round bodies of lumbar vertebræ beneath psoas, the two upper ones passing also beneath pillars of diaphragm, and those of right side beneath inferior vena cava; and divide between transverse processes into:
ABDOMINAL BRANCH – Behind quadratus lumborum (the lowest one sometimes in front), and between abdominal muscles, joining with epigastric, internal mammary, intercostals, ilio-lumbar & circumflex iliac.
DORSAL BRANCH – Sends a spinal branch through intervertebral foramen to cauda equina & posterior surface of bodies of vertebræ, and passes backwards to muscles & integument of back.

Sacra Media – Small; from back of aorta at point of bifurcation.
Descends upon middle of sacrum, anastomosing with both lateral sacral.

COMMON ILIAC ARTERY.

Downwards & outwards from bifurcation of aorta a little to the left of 4th lumbar vertebra to opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis), where it divides into external & internal iliacs. Is about two inches long, the right artery being slightly the longer.

RELATIONS :

Right Side:

In Front – Small intestine, peritoneum, sympathetic nerve, ureter near bifurcation.

Behind – Both common iliac veins.

Outer Side – Right common iliac vein, inferior vena cava, psoas muscle.

Left Side:

In Front – Same, plus rectum & superior hæmorrhoidal artery.

Outer Side – Psoas.

Left Common Iliac Vein – Lies at first on inner side of its artery, and then passes beneath artery of right side.

Right Common Iliac Vein – Lies at first behind its artery, and then on its outer side.

BRANCHES — Very small & not named, sometimes **Renal & Ilio-lumbar.**

EXTERNAL ILIAC ARTERY.

Downwards & outwards along inner border of psoas, extending from bifurcation of common iliac opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) to beneath Poupart's ligament midway between anterior superior spine of ilium & symphysis pubis, where it becomes femoral artery. Rather larger in the adult than internal iliac; half the size in the fœtus.

RELATIONS: —

In Front – Intestine, peritoneum, thin layer of fascia derived from the iliac; spermatic vessels & nerves, genital branch of genito-crural nerve, circumflex iliac vein, sometimes ureter near origin.

Behind on Right Side – External iliac vein, which lies on inner side at femoral arch.

On Inner Side – External iliac vein, & vas deferens.

On Outer Side – Iliac fascia & psoas muscle.

Left External Iliac Vein lies altogether on inner side of its artery.

Right External Iliac Vein lies at first on inner side of its artery, and then behind it.

BRANCHES: —

Epigastric – Somewhat the larger. From front of external iliac a few lines above Poupart's ligament.

Descends slightly to reach level of the ligament.

Ascends obliquely upwards & inwards in subperitoneal areolar tissue, passing behind inguinal canal & along lower & inner boundaries of internal abdominal ring, and hooking round vas deferens in the male, round round ligament in the female.

Pierces sheath of rectus between its middle & lower thirds, and ascends behind the muscle, dividing into muscular & cutaneous branches, which anastomose with lower intercostals, lumbar, superior epigastric of internal mammary, & superficial epigastric of femoral. – Gives off branches:

Cremasteric – Small, descends upon spermatic cord and supplies cremaster; anastomoses with spermatic.

Pubic – Usually small; descends behind pubes on inner side of femoral ring, and anastomoses with obturator. Sometimes greatly increased in size so as to form the origin, or one of the origins, of the obturator artery, which artery is then said to arise from the epigastric (Vide obturator artery). – The two epigastric veins unite into one trunk, which opens into the external iliac.

Circumflex Iliac – Somewhat the smaller. From outer side of external iliac near Poupart's ligament.

Upwards & outwards behind the ligament, and along anterior half of inner lip of crest of ilium, joining with gluteal.

Pierces transversalis, runs backwards between it & the internal oblique, and joins with ilio-lumbar. Gives off numerous muscular branches; one, rather large, ascends from anterior superior spine of ilium, and joins with the epigastric & lumbar. – The two circumflex iliac veins unite into one trunk, which crosses the external iliac artery and opens into the corresponding v.

LUMBAR PLEXUS.

Formed by anterior divisions of four upper lumbar nerves, and situated in substance of psoas, in front of transverse processes of the lumbar vertebræ.

Narrow above, where it usually receives a small branch from last dorsal nerve; broad below, where it is joined to the sacral plexus by a branch from 4th lumbar nerve & by lumbo-sacral nerve or cord.

Its arrangment is as follows: – (Vide Quain's diagram).

1st Lumbar Nerve – Gives off:
Ilio-hypogastric,
Ilio-inguinal,
Small part of Genito-crural,
Communicating branch to 2nd Lumbar.

2nd Lumbar Nerve – Completes
Genito-crural, – and gives off
Greater part of External Cutaneous, and
Communicating branch to 3rd Lumbar, from which communicating branch the *Anterior Crural, Obturator, & Accessory Obturator* nerves (when the latter exists) are partly derived

3rd Lumbar Nerve – Completes
External Cutaneous, and gives off
Greater part of Anterior Crural, Obturator & Accessory Obturator Nerves (when the latter exists), and a
Communicating branch to 4th Lumbar.

4th Lumbar Nerve – Completes
Anterior Crural, Obturator, & Accessory Obturator Nerves, (when the latter exists), and gives off a
Large branch to 5th Lumbar, which large branch forms with the latter nerve the *Lumbo-Sacral Nerve or Cord.*

LATERAL BRANCHES of the LUMBAR PLEXUS.

ILIO-HYPOGASTRIC — From 1st lumbar.

Emerges from *upper part of outer border of Psoas.*

Crosses quadratus lumborum.

Perforates transversalis, and divides between it & internal oblique into branches: –

ILIAC – Pierces internal & external oblique just above crest of ilium, and supplies skin of gluteal region behind lateral cutaneous branch of twelfth dorsal nerve.

HYPOGASTRIC – Forwards between internal oblique & transversalis, communicating with ilio-inguinal. Pierces internal oblique & aponeurosis of external oblique a little above the external abdominal ring, and supplies skin of hypogastric region.

ILIO-INGUINAL — From 1st lumbar; smaller than foregoing.

Pierces psoas, and crosses quadratus lumborum *immediately below ilio-hypogastric.*

Pierces transversalis, and communicates with hypogastric branch of ilio-hypogastric between that muscle and the internal oblique, which it pierces a little further on.

Through inguinal canal in front of spermatic cord; and supplies skin of upper & inner part of thigh and of scrotum & penis, or of labium pudendi.

Is sometimes small, and then ends by joining the ilio-hypogastric near crest of ilium; in that case a branch of the ilio-hypogastric takes the place of the ilio-inguinal.

GENITO-CRURAL — From 2nd lumbar nerve, and by a few filaments from the 1st.

Descends obliquely *through substance, and afterwards on anterior surface of psoas,* and divides into branches: –

GENITAL – Over external iliac artery, and through inguinal canal behind spermatic cord, to cremaster muscle & scrotum; – in female behind round ligament to labium.

CRURAL – Beneath Poupart's ligament on inner side of psoas. Pierces fascia lata on outer side of femoral artery, and supplies skin of upper and front part of thigh; communicates with middle cutaneous.

EXTERNAL CUTANEOUS — From 2nd lumbar nerve, and, by a few filaments, from the 3rd.

Pierces psoas muscle towards its middle and crosses iliacus.

Passes beneath Poupart's ligament through notch below anterior superior spine of ilium, and divides into branches: –

ANTERIOR – Pierces fascia lata about four inches below Poupart's ligament, and supplies skin of anterior & outer aspects of thigh as low as knee.

POSTERIOR – Supplies skin of outer & posterior aspect of thigh.

THE DIAPHRAGM.

Is fan-shaped; the expanded portion of the fan being horizontal, and the narrow portion or handle, vertical. It presents for examination its points of origin & the fibres arising from them, its central or cordiform tendon, its openings, & its relations.

POINTS OF ORIGIN & FIBRES ARISING FROM THEM:

Ensiform Cartilage – Gives attachment to a narrow & sometimes tendinous slip, on either side of which the costal cartilages & the costal fibres bound a narrow triangular area, over the extent of which area the pleuræ & the peritoneum are separated only by a little areolar tissue.

Cartilages & Osseous Portions of the 6 or 7 Lower Ribs – Give rise to the long arched lateral fibres, which, at their point of origin, interdigitate with the transversalis.

Ligamentum Arcuatum Internum – A thickened band of the fascia over the psoas, extending from side of body of 1st, & sometimes from that of 2nd lumbar vertebra, to tip of transverse process of 1st & sometimes to that of 2nd. Gives rise to arched fibres similar but rather shorter.

Ligamentum Arcuatum Externum – A thickened band of the fascia over quadratus lumborum (anterior lamella of posterior abdominal aponeurosis), extending from tip of transverse process of first lumbar vertebra, & sometimes from that of 2nd, to lower border & apex of last rib. Gives rise to similar arched fibres.

Bodies of Second, Third & Fourth Lumbar Vertebræ by means of the

CRURA — Two thick fibro-muscular bundles, which arise by tendinous fibres as follows:

RIGHT CRUS – The thickest & longest, from front of bodies & intervertebral substances of 1st, 2nd, & 3rd, or sometimes of 2nd, 3rd, & 4th lumbar v., & from ant. common ligt. of spine.

LEFT CRUS – The shortest & narrowest, from left side of bodies & intervertebral substances of 1st & 2nd or sometimes of 2nd & 3rd lumbar vertebræ, & from ant. common ligt. of spine.

The tendons ascend for a short distance on either side of the aorta, and then become joined in front of that vessel by means of a tendinous arch formed by the blending of their innermost fibres. The crura then give rise, as well as the intervening arch to two large fleshy bellies, the outer fasciculi of which bellies pass upwards & outwards to the cordiform tendon, while the inner ones first decussate in front of the aorta (those of the right side being the largest & most anterior), then diverge to surround the œsophagus, and finally meet again in front of it before they end in the central tendon. (In some very rare cases these fasciculi do not join in front of the œsophagus, a portion of the anterior margin of the œsophageal opening is then tendinous).

CENTRAL or CORDIFORM TENDON — The common insertion of all the fibres. Has somewhat the shape of a trefoil leaf; and presents anteriorly three leaflets; the right one is long, broad, & the largest; the left one, long, narrow, & the smallest; the middle one short, broad, & intermediate in size.

OPENINGS — Are:

Large Openings – Three:

AORTIC OPENING – For aorta, vena azygos major, thoracic duct & frequently the left cord of the sympathetic. Lies in middle line, and is osteo-fibrous, being bounded behind by bodies of vertebræ, laterally by tendons of the crura, and in front by the fibrous arch which joins the latter.

ŒSOPHAGEAL OPENING – For œsophagus & pneumogastric nerves. Lies higher up, & a little to the left. Is oval in form & entirely muscular, being formed by the inner decussating fasciculi of the fleshy portion of the crura; – in some very rare cases a portion of the anterior margin is fibrous, & formed by the posterior border of cordiform tendon.

OPENING FOR INFERIOR VENA CAVA – The highest; lies a little to the right between right & middle leaflets of cordiform tendon. Is quadrilateral & fibrous, being bounded by four bundles of tendinous fibres which meet at right angles.

Small Openings – Transmit;

Right cord of sympathetic, & sometimes the left;
Right & left great, lesser, & least splanchnic nerves, either separately or conjointly.
Vena azygos minor, & sometimes the major – These openings vary therefore in number.

RELATIONS —

Of Upper Surface:

LATERALLY – Pleuræ; lungs. Also at circumference of thorax for a considerable though variable extent, lower ribs & lower intercostal spaces, the lungs not descending under ordinary circumstances as low as the costal attachments of the diaphragm & the point of reflection of the pleuræ The lateral portions of the diaphragm are the most movable; their degree of elevation or depression varies much more than that of the central part in accordance with the respiratory movements, and with the degree of distension, or otherwise, of the stomach, intestines, & uterus. The right lateral portion of the diaphragm, on account of the pressure of the liver on that side, rises by one or two ribs' breadths higher than the left, and reaches the level of

In Forced Expiration – 4th costal cartilage;
In State of Repose of Thorax – 5th costal cartilage;
In Forced Inspiration – Line from ensiform cartilage, to back of 10th rib.

CENTRALLY – Heart & base of pericardium, the fibrous layer of which latter sac blends more particularly with the anterior & left part of central leaflet of cordiform tendon, & with the fascia covering the left anterior costal fibres. The central part of the diaphragm is flattened & less movable, and lies on a lower level than the lateral portions, except close to the sternum, in front, & to the vertebræ, behind, where, on the contrary, it rises a little higher.

Of Under Surface – This is entirely covered by peritoneum except behind pancreas, kidneys & suprarenal capsules, and at points of attachment of coronary & lateral ligaments of liver, gastro-phrenic ligament, & suspensory ligament of spleen; it lies in mediate contact with liver, stomach & spleen.

PELVIS & MALE GENITO-URINARY ORGANS.

PERITONEUM.

Downwards in front of spine & Aorta;
Over upper part of rectum, forming *meso-rectum;*
Forwards:
In Male: – To bladder, forming *posterior false ligaments of bladder & recto-vesical pouch;*
In Female: – To vagina & uterus, forming *posterior ligaments of uterus & recto-vaginal pouch*; and then over uterus & from uterus to bladder, forming *anterior ligaments of uterus & utero-vesical pouch;*
Over bladder and from bladder to anterior wall of abdomen;
Up to umbilicus, covering urachus & obliterated hypogastric arteries.

THE PELVIC FASCIA.

Is continuous with fascia over psoas & iliacus and with fascia transversalis, and is slightly adherent to brim of pelvis, especially at sides.

It is thin posteriorly, where it covers pyriformis muscle & sacral plexus, and passes behind internal iliac vessels which perforate it.

In front it forms a single thick layer over obturator internus as low down as a white linear thickening, which linear thickening extends in a curved direction from spine of ischium to side of lower part of symphysis pubis, and both gives attachment to middle fibres of levator ani, and marks point of division of pelvic fascia into recto-vesical & obturator layers, or recto-vesical & obturator fasciæ.

Recto-Vesical Fascia -

Is continued over inner surface of levator ani to bladder, prostate or vagina, & rectum.

In front it forms anterior true ligaments of bladder, or pubo-prostatic ligaments.

Further back it ascends over side of prostate, inclosing this gland & the prostatic plexus of veins, and is then continued on the bladder forming its lateral true ligaments.

Posteriorly it sends a prolongation between the bladder & rectum, which prolongation invests the vesiculæ seminales.

Obturator Fascia -

Descends on portion of obturator internus muscle which lies beneath levator ani, and becomes attached to pubic arch & sacro-sciatic ligaments.

It forms a canal for pudic vessels & nerve, and gives off a thin layer, the anal or ischio-rectal fascia, to under surface of levator ani & to third part of rectum.

SIDE VIEW of the MALE PELVIS.

How to obtain it (the Perinæum having been previously dissected): –

Incline bladder & rectum to the right.
Divide on left side obliterated hypogastric, vesical & middle hæmorrhoidal arteries, (and the uterine & vaginal in female), lateral true ligament of bladder & levator ani muscle.
Saw through pubes externally to left anterior true ligament of bladder.
Divide right common iliac artery & left common iliac vein, and saw through sacrum & coccyx just to the left of middle line.
Detach deep perinæal fascia & the contained compressor urethræ muscle from rami of pubes & ischium.
Introduce catheter into, and inflate, bladder; distend rectum with tow.

What it shows: –

Towards middle: –

Cut edge of the deep perinæal fascia, containing between its two layers: –
Cut edges of compressor urethræ & deep transverse muscles;
Membranous portion of urethra;
Pudic vessels & nerve with the vessels & nerve of the bulb;
Cowper's glands & their ducts.

Below and in front of the deep perinæal fascia: –

Bulb of urethra partly covered by prolongation of anterior or inferior layer of deep perinæal fascia, which latter passes down upon it and becomes lost on its surface.

Above and behind the deep perinæal fascia: –

Cut edges of levator ani muscle & of recto-vesical layer of pelvic fascia, which latter is seen further up to ascend upon bladder, prostate, & rectum.

The viscera of the pelvis and the vessels & nerves of the right side can now be examined conveniently.

THE RECTUM.

Commences opposite left sacro-iliac synchondrosis.
Passes downwards & to the right to middle, or to a little to the right of middle, of third piece of sacrum.
Curves forwards upon concavity of sacrum & coccyx, regaining middle line if latter has been passed.

Inclines downwards & backwards to anus.
Is smooth & cylindrical, not sacculated; about 8 inches long. Rather narrower above than sigmoid flexure, but it increases as it descends, and is greatly dilated just above anus. – Divided into three parts:

UPPER PART — From sacro-iliac synchondrosis to middle, or to a little to the right of middle, of third piece of sacrum; about 4 inches long.
Almost completely surrounded by meso-rectum.
Separated by small intestine from bladder, in the male, & from uterus & vagina, in the female; and connected inferiorly with latter organs by the folds of peritoneum which form margins of recto-vesical & recto-vaginal pouches respectively.
Rests upon pyriformis muscle & sacral plexus of left side.
Has to its left side left ureter & branches of left internal iliac artery.

MIDDLE PART — From middle of third piece of sacrum to tip of coccyx; about 3 inches long.
Covered by peritoneum in front & at sides above, in front only towards middle, not at all below.

In relation below & in front with:

In the Male – Triangular portion of base of bladder, vesiculæ seminales & vasa deferentia, and under surface of prostate.
In the Female – Middle part of posterior wall of vagina, to which it is closely adherent.

LOWER PART — From tip of coccyx to anus; about an inch in length.
Invested by the internal & external sphincters & by the levatores ani.
Separated by a triangular space, the perinæum, from membranous portion of urethra & bulb, in the male, from vagina, in the female.

STRUCTURE — Presents:

Serous Coat – Covers upper & middle parts of rectum, the former almost completely, the latter in front & at sides above, in front only towards middle, not at all below.

Muscular Coat – Very thick; consists of fibres:
External Longitudinal – Form a thick uniform layer all round intestine.
Internal Circular – Are most numerous at lower end of rectum, where they form internal sphincter

Cellular Coat – Forms a loose connection between the muscular & mucous coats.

Mucous Membrane – Thick, very vascular, freely movable upon muscular coat. Presents:
Longitudinal Folds – Most marked below; due to contraction of sphincter and disappear on distention.
Permanent Transverse Folds, or Folds of Houston – Three principal ones, semilunar, sometimes half an inch in depth, situated at upper part on right side, near middle of rectum on left side, and at front part opposite base of bladder.

Vessels & Nerves – Arteries. From superior, middle & inferior hœmorrhoidal; they form a rich network beneath & within mucous membrane, the meshes of which network are mainly longitudinal in lower part of rectum, and connected opposite anus, by large transverse branches (Quain). –Veins Also mainly longitudinal near anus; open partly into internal iliacs & partly into inferior mesenteric. – Lymphatics. Open into glands in hollow of sacrum, or into lumbar glands. – Nerves. From sacral plexus, 4th sacral & inferior hœmorrhoidal nerves, and from inferior mesenteric & hypogastric plexuses.

THE KIDNEY.

Is situated in lumbar region behind peritoneum, and extends from 11th rib to near crest of ilium, right kidney lying a little lower than left one.

Presents:

Ant. Surface – Convex, looking slightly outwards, covered at upper & outer part by peritoneum, and in relation with:
On Right Side – Right lobe of liver, descending portion of duodenum, ascending colon.
On Left Side – Tail of pancreas, lower end of spleen, descending colon.

Post. Surface – Flat; rests upon 11th & 12th ribs, crus of diaphragm, psoas magnus, and anterior lamella of aponeurosis of transversalis, which latter separates it from quadratus lumborum.

Sup. Extremity – Thick, rounded, directed inwards, covered by suprarenal capsule. Corresponds on left side to upper border, on right side to lower border, of 11th rib.

Inf. Extremity – Smaller, flattened, directed outwards. Descends to near crest of ilium.

Outer Border – Convex, directed backwards & slightly upwards.

Inner Border – Concave, directed forwards & slightly downwards. Presents the *hilum*, a longitudinal fissure most marked behind, which leads into the *sinus*, and contains from before backwards renal vein, renal artery & ureter.

The kidneys are subject to frequent

VARIATIONS in:

Form & Size – One or both being longer & narrower, or shorter & more rounded; or one being more or less enlarged & the other proportionately diminished.

Situation – One or both being situated lower down than usual, occasionally in the pelvis.

Number – There being but one kidney sometimes of a horse-shoe shape & situated in front of the vertebræ, or there being a supernumerary kidney.

THE URETER.

The excretory duct of the kidney commences in the

Calices, – small tubes from 7 to 13 in number, which embrace each of them one, two or more papillæ, and join to form the

Infundibula, – larger tubes usually three in number, which join to form the

Pelvis – funnel shaped dilatation of upper part of ureter compressed from before backwards, and situated at lower & back part of hilum.

The ureter passes:

Downwards & inwards upon psoas, beneath peritoneum & spermatic vessels, and, on the right side, on right side of inferior vena cava;

Over common or external iliac artery, being covered by termination of ileum on the right side, by sigmoid flexure of colon, on the left;

Forwards & inwards, –

In the Male – In posterior false ligament of bladder, and on outer side of vas deferens & below obliterated hypogastric artery,

In the Female – In posterior ligament of uterus and over side of cervix uteri & upper part of vagina, –

to posterior angle of trigonum vesicæ, passing obliquely through walls of bladder for about ⅔ of an inch.

It is from 16 to 18 inches long, and of about the diameter of a crow-quill.

The calices, infundibula, pelvis & ureter are formed of fibrous, muscular & mucous coats. The muscular coat consists, in the greater part of the ureter, of two longitudinal layers comprising an intermediate circular one; the epithelium of the mucous coat is spheroidal

THE BLADDER.

When

Empty, – Is deeply situated behind pubes, in front of rectum, in the male, of uterus & vagina, in female, and is compressed from before backwards & triangular with base downwards ;
Moderately full, – Is rounded, and partly fills pelvis ;
Distended, – Becomes egg-shaped, curves slightly forwards, and rises into abdominal cavity sometimes as high as umbilicus.

In Female bladder is normally smaller, though sometimes larger through distention, and is widest from side to side. In Children it is conical, and points up higher into abdomen.

Presents:

Ant. Surface – Destitute of peritoneum, and in relation with triangular ligament of urethra, pubes & pubo-prostatic ligaments, and with anterior wall of abdomen in children, and also in adults when bladder is distended.

Post. Surface – Covered by peritoneum, and separated by convolutions of small intestine from rectum in the male, and uterus in the female.

Lateral Surfaces – Crossed towards their middle by obliterated hypogastric artery, below & behind by ureter, above & behind in male by vas deferens, which latter first crosses hypogastric artery externally, and then passes between bladder & ureter. – Covered by peritoneum above & behind hypogastric artery, and rest below & in front on pelvic fascia.

Apex – Connected to umbilicus by urachus & by obliterated hypogastric arteries, behind which it is covered by peritoneum.

Base or Fundus – The enlarged part directed downwards & backwards. – In relation with

In the Male – Second portion of rectum, upon which rests the part bounded by the recto-vesical fold of the peritoneum, the vesiculæ seminales & vasa deferentia, and the prostate gland. – Is covered behind by peritoneum, the recto-vesical fold descending to about four inches from the anus when the bladder is distended, and nearly reaching the prostate when the bladder is empty.

In the Female – Anterior wall of vagina & lower part of cervix uteri.

Neck – Directed downwards & forwards, and now known to be the lowest part of the bladder both in the male & female, when in the erect posture; is surrounded in the male by the prostate gland.

LIGAMENTS of the BLADDER

Are five true ligaments, and five false ones formed by peritoneum.

TRUE LIGAMENTS — Anterior & Lateral formed by pelvic fascia & Superior or Urachus, a remnant of allantois.

ANT. OR PUBO-PROSTATIC LIGAMENTS — From back of pubes on either side of symphysis to front of neck of bladder & upper surface of prostate. Contain a few muscular fibres passing to bladder, and are separated by a narrow groove containing dorsal vein of penis.

LATERAL LIGAMENTS — Broad & thin; formed by recto-vesical layer of pelvic fascia as it passes from upper surface of levator ani to capsule of prostate & side of bladder.

URACHUS, or SUP. LIGAMENT — Fibro-muscular cord extending from apex of bladder, where it is wide & expanded, to umbilicus, where it is contracted and lost in umbilical cicatrix. Sometimes partly pervious, communicating with bladder, sometimes completely pervious forming umbilical urinary fistula.

FALSE LIGAMENTS — Posterior, Lateral & Superior.

POST. FALSE LIGAMENTS — The margins of the recto-vesical pouch of peritoneum in the male, of the utero-vesical pouch in the female, where they are much smaller. Contain the obliterated hypogastric arteries & ureters.

LATERAL FALSE LIGAMENTS — From sides of pelvis to sides of bladder.

SUP. FALSE LIGAMENT — Over urachus & obliterated hypogastric arteries to umbilicus.

COVERINGS of the TESTICLE.

Are the: –

Scrotum – Consists of two layers:

INTEGUMENT – Thin & brownish; presents a few sebaceous follicles & thinly scattered crisp hairs, and is divided into two lateral halves by a median raphé, which raphé is continued forwards on under surface of penis and backwards along middle line of perinæum to anus. Is closely applied to the testes and is corrugated transversely when the dartos is contracted, that is to say, usually in the young & robust, and in all under the influence of cold, and is elongated & flaccid when the dartos is relaxed, that is to say, usually in the debilitated & aged, and in all under the influence of warmth.

DARTOS – Is a thick stratum of loose reddish tissue, a modification of the superficial fascia of the surrounding regions, consisting of areolar tissue with numerous superadded muscular fibres and without any fat; it sends inwards between the two testicles a septum, the *septum scroti*, which divides its cavity into two. – It is contractile, but its contractility is slow in its action, and especially excited by cold, not by electricity.

Intercolumnar or External Spermatic Fascia – Thin cellular layer derived from the margins of the external abdominal ring during the descent of the testis, and continuous above with the intercolumnar fibres, which bound that ring superiorly.

Cremasteric Fascia – Consists of the scattered bundles of fibres of the cremaster & internal oblique muscles united by a little areolar tissue.

Fascia Propria – Relatively thick layer, the continuation of the infundibuliform process of the fascia transversalis, which layer supports both the cremasteric fascia & the tunica vaginalis reflexa.

Tunica Vaginalis – Is derived from the peritoneum, of which it is at first a continuation, but from which it is subsequently cut off by the closure of that part of the peritoneal pouch, which extends from the internal abdominal ring to a short distance from the testicle. – Is divided into:

VISCERAL PORTION OR TUNICA VAGINALIS PROPRIA – Surrounds the testicle, and covers both the upper or outer surface of the epididymis and also the under surface of its central part or body, penetrating, along its outer border, between it & the testicle, and thus forming the *digital fossa*.

PARIETAL PORTION, OR TUNICA VAGINALIS REFLEXA – Is reflected from the posterior border of the testicle upon the inner surface of the fascia propria, extending, however, a short distance up the cord upon its anterior & inner aspects.

THE TESTICLE & EPIDIDYMIS.

THE TESTICLE

Is oval & compressed laterally, and so suspended by the spermatic cord as to present:

Upper Extremity – The largest, directed forwards & outwards. Presents a small pedunculated body, the hydatid of Morgagni, probably a remnant of Muller's duct.

Lower Extremity – The smaller, directed backwards & inwards.

Lateral Surfaces – Looking respectively forwards & inwards, and backwards & outwards.

Anterior Border – Convex, directed forwards, downwards & outwards. – All these parts are free, smooth, and entirely invested by the tunica vaginalis propria.

Posterior Border – Straight & flattened, directed backwards, upwards & inwards, covered by the epididymis & vas deferens, and only partly invested by the tunica vaginalis.

The left testicle lies a little lower than the right one, and is frequently a little larger.

THE EPIDIDYMIS

Lies on the posterior border and back part of the outer surface of the testicle, and has the vas deferens on its inner side. It presents:

Globus Major or Head – Its upper enlarged extremity, connected to the testicle by the efferent ducts of the latter.

Body – Free, surrounded by the tunica vaginalis, which dips in between it & the testicle along its outer border, and connects its inner or posterior border to the posterior border of the testicle.

Globus Minor or Tail – Its lower pointed extremity, attached to the testicle by dense fibrous tissue.

The tunica vaginalis covers the whole of the upper or outer surface of the epididymis, as well as the under surface of its body. – The vas aberrans of Haller communicates with the canal of the epididymis or with the commencement of the vas deferens

STRUCTURE of the TESTICLE & EPIDIDYMIS.

STRUCTURE of the TESTICLE — Presents for examination: -

THREE IMMEDIATE COVERINGS: —

Tunica Vaginalis - Vide Coverings of the testicle.

Tunica Albuginea - Thick, dense, bluish-white, fibrous membrane, covered externally by the tunica vaginalis propria except along the points of attachment of the epididymis & vas deferens, and reflected into the interior of the testicle along its posterior or upper border in the shape of an incomplete vertical septum, the mediastinum testis or Corpus Highmorianum. This latter body supports the vessels & nerves and the excretory ducts of the testicle in their passage to or from the gland, and gives off numerous trabeculæ, which radiate towards the whole extent of the inner surface of the tunica albuginea, and inclose the numerous pyramidal spaces containing the lobules of the gland substance.

Tunica Vasculosa or Pia Mater Testis - Consists of a plexus of blood-vessels held together by delicate areolar tissue, and formed by the subdivision of the superficial set of brs. of the spermatic artery. Branches given off by this plexus, penetrate into the substance of the gland, supported by the trabeculæ.

PROPER SUBSTANCE or PARENCHYMA — Consists of numerous pyramidal lobules contained in the pyramidal spaces bounded by the trabeculæ, and presenting a base directed towards the surface of the testicle and an apex directed towards the mediastinum. Of these lobules the central ones are the largest. The degree to which the lobules are isolated by the trabeculæ is somewhat variable, hence the different estimates of their number, 250 (Berres), 400 (Krause).

Each lobule consists of from *one to three or more tubuli seminiferi*, the number & the length of which tubuli has also been variously estimated,- 300, sixteen feet in length (Monro), 840, two feet & a quarter in length (Lauth). - The diameter of the tubuli is from $\frac{1}{200}$ to $\frac{1}{100}$ of an inch. They consist from without inwards of a delicate fibro-areolar coat, a basement membrane, and sometimes a layer of granular nucleated epithelium. The epithelium is absent, however, when the gland is particularly active; the tubuli are then filled with cells of different sizes without any regular arrangement.

The *tubuli seminiferi* commence towards the surface of the testicle, sometimes by free cœcal or blind extremities, but more commonly by anastomatic loops. They are exceedingly convoluted in the peripheral part of the gland; their convolutions are of two orders, viz., a fine & regular undulation giving a granular appearance to the whole of their mass, and a more complicated folding of the undulating tube. Towards the apices of the lobules they become straighter, and they coalesce into from twenty to thirty straight tubes the *vasa recta*, which are from $\frac{1}{100}$ to $\frac{1}{60}$ of an inch in diameter.

The *vasa recta* enter the mediastinum, and passing upwards & backwards, they form within that body a network of anastomosing tubules, the *rete testis* or *rete vasculosum testis*.

The rete testis is continued superiorly into from twelve to fifteen or twenty *vasa efferentia*

The *vasa efferentia* perforate the tunica albuginea at the upper & back part of the testicle. In their extra-testicular course, which is about 6 or 8 inches long, they are at first straight & relatively wide, but they soon become convoluted & slightly narrowed, and form a series of conical masses, the *coni vasculosi*, which latter constitute together the globus major of the epididymis. They are lined with ciliated epithelium.

The excretory ducts of the testicle open finally into the commencement of the canal of the epididymis at apparently narrow intervals, which intervals however, are seen, when the canal of the epididymis is unravelled, to measure from two to three inches in length.

STRUCTURE of the EPIDIDYMIS — The epididymis consists of a single tube about twenty feet long, by which the tubuli seminiferi open into the vas deferens. It is at first very thin & exceedingly convoluted, and of a diameter of about $\frac{1}{70}$ of an inch. It diminishes a little in size for a short distance, but it soon increases considerably, the thickness of its walls increasing also, and its course becoming less tortuous. A little fine areolar tissue binds its convolutions together, thicker septa being interposed between the larger masses of coils termed *lobes*, which latter are mostly transverse in direction. The epithelium of the canal of the epididymis is ciliated (Becker, Kölliker). - The Vas aberrans of Haller (Vide spermatic cord) is usually connected either with the canal of the epididymis or with the commencement of the vas deferens.

THE VAS DEFERENS, VESICULÆ SEMINALES, & EJACULATORY DUCTS.

VAS DEFERENS

Ascends on inner side of epididymis along lower three-fourths of posterior border of testicle, to which it is attached by firm areolar tissue.

Along back of spermatic cord to external abdominal ring;

Through external abdominal ring, inguinal canal & internal abdominal ring;

Downwards, backwards, inwards to base of bladder, passing on outer side of epigastric & obliterated hypogastric arteries and then on inner side of ureter;

Forwards & inwards between bladder & rectum, along inner side of vesicula seminalis becoming enlarged & sacculated;

Narrows to a point, and joins opposite base of prostate with duct of corresponding vesicula seminalis, to form the common seminal or ejaculatory duct.

Its canal is very small. Its walls are very thick & dense, and consist from without inwards of a cellular coat, of a muscular coat presenting two longitudinal layers & an intermediate circular layer of fibres, and of a mucous coat covered with columnar non-ciliated epithelium.

The vas aberrans of Haller communicates with the canal of the epididymis or with the commencement of the vas deferens.

VESICULÆ SEMINALES

Two lobulated membranous pouches about 2½ inches long obliquely disposed between base of bladder & second part of rectum, and presenting:

Post. Diverging Extremities – Enlarged, and reach as far back as termination of ureters.

Ant. Converging Extremities – Pointed; join at base of prostate with termination of the corresponding vas deferens to form the common seminal or ejaculatory duct.

Upper Surface – In contact with base of bladder.

Under Surface – Rests upon second part of rectum, from which it is separated by a process of the recto-vesical layer of the pelvic fascia.

They have the enlarged & sacculated vasa deferentia to their inner side, and bound laterally a triangular portion of the base of the bladder which corresponds to trigonum vesicæ.

Each vesicula seminalis consists of a tube from four to six inches long, and of about the diameter of a crow quill. This tube is irregularly coiled upon itself, and gives off numerous cœcal diverticula, which, as well as the coils of the tube, are bound together by firm areolar tissue. Its walls are thin, and consist of fibrous, muscular & mucous coats, the epithelium of the latter being squamous.

EJACULATORY DUCTS

Two small canals about ¾ of an inch in length formed by the junction opposite the base of the prostate of the vas deferens with the duct of the vesicula seminalis.

They pass forwards & inwards through the substance of the prostate along the side of the verumontanum, and terminate by a slit-like opening upon or within the margins of the vesicula prostatica or sinus pocularis.

Their walls are thin, and consist of a delicate fibrous coat & of muscular & mucous coats.

THE SPERMATIC CORD.

Consists of the portion of the vas deferens which extends from the testicle to the internal abdominal ring, and of the accompanying arteries, veins, lymphatics, & nerves and contains the vas aberrans & the organ of Giraldes. These structures are bound together by delicate areolar tissue, and are invested from within outwards by:

Tunica vaginalis, below;

Fascia propria, along the whole

Cramasteric fascia, along nearly the whole of the course of the cord;

Intercolumnar fascia, dartos & skin of the scrotum, below the external abdominal ring.

Vas deferens – Lies at the back.

Arteries – Are the *spermatic*, the *artery of the vas deferens* from the superior vesical, and the *cremasteric* branch of the epigastric.

Veins – Are the spermatic veins, which pass up in front of the vas deferens, forming the *pampiniform plexus*, and then unite in a single trunk, which accompanies the abdominal portion of the spermatic artery and terminates in the left renal vein, on the left side, in the inferior vena cava, on the right.

Lymphatics – Terminate in the lumbar glands.

Nerves – Are the *ilio-inguinal*, the *genital branch of the genito-crural*, frequently a branch of the ilio-hypogastric, and the *spermatic plexus of the sympathetic*, which latter is derived from the renal, aortic & hypogastric plexuses.

Vas Aberrans (Haller) – A narrow tortuous tube from 1½ to 1¼ inches long, connected with the commencement of the vas deferens or with the lower part of the canal of the epididymis, and passing upwards for 1 or 2 inches among the other vessels of the spermatic cord. It ends in a blind extremity, and is sometimes unconnected with the seminal ducts. It was probably connected in the fœtus with the Wolffian body.

Organ of Giraldes – A collection of minute convoluted tubules, probably a remnant of the Wolffian body, found in the lower & front part of the cord close to the head of the epididymis.

THE PROSTATE GLAND.

It is a pale firm glandular structure of about the size & shape of a horse-chesnut, situated beneath the trigonum vesicæ and around the neck of the bladder & commencement of the urethra; below and behind the symphysis pubis & the pubo-prostatic ligaments or anterior true ligaments of the bladder; above & in front of the second part of the rectum and the point of decussation of those anterior or inner fibres of the levator ani which form the levator prostatæ; between the two lateral halves of the posterior or ascending layer of the deep perinæal fascia or triangular ligament, and between the two lateral halves of the ascending portion of the recto-vesical layer of the pelvic fascia.

It measures normally from 1¼ to 1½ inches in its antero-posterior diameter, 1¾ inches in its greatest transverse diameter (Sir H. Thompson), and about ⅝ of an inch in depth; these measurements undergo, however, great variations in old persons, who are frequently the subjects of enlarged prostate.

It consists of two lateral lobes separated behind by a deep notch, and of a third or middle lobe which is normally but a small rounded or triangular mass fitted in between the two lateral lobes in the under part of the organ, and lying between the ejaculatory ducts immediately beneath the neck of the bladder. The degree of development of this middle lobe, is however, very variable, it being often much enlarged in advanced life, and then projecting into the neck of the bladder so as to impede the passage of urine.

It presents for examination:

BASE — Directed backwards & upwards towards the trigonum vesicæ & the neck of the bladder, and notched posteriorly.

APEX — Passes downwards & forwards between the posterior or ascending layers of the deep perinæal fascia or triangular ligament.

UPPER SURFACE — Covered by and connected to the pubo-prostatic ligaments or ant. true ligaments of the bladder and the front part of the recto-vesical layer of the pelvic fascia. Is situated about ⅝ of an inch below & behind the symphysis pubis, and presents a slight longitudinal furrow.

UNDER SURFACE — Rests upon the lower part of the second portion of the rectum (just opposite the bend between the second & third portions), a process of the recto-vesical layer of the pelvic fascia being interposed between the two organs. Presents a slight depression, or sometimes two converging grooves which correspond to the ejaculatory ducts and which demarcate the central lobe.

LATERAL SURFACES — Covered by the layers of fascia above mentioned, by those anterior or inner fibres of the levatores ani which go to form the levator prostatæ, and by the reflections of the peritoneum from the bladder to the sides of the pelvis which reflections form the lateral false ligaments of the bladder.

It is perforated by the urethra, which usually lies nearer its upper than its lower surface, and also by the ejaculatory ducts which pass forwards & inwards through the lower part of the gland along the side of the verumontanum, and terminate by a slit-like opening upon or within the margins of the vesicula prostatica or sinus pocularis.

STRUCTURE — Structurally the prostate presents:

Fibrous Capsule — Distinct from the fibrous investment derived from the two halves of the posterior or ascending layer of the deep perinæal fascia & from the recto-vesical layer of the pelvic fascia, and separated from these by prostatic plexus of veins. It sends off fibrous prolongations into the interior of the gland.

Glandular Subtance — Consists of follicular pouches which are grouped around, and open into, numerous elongated canals, by the junction of which from twelve to twenty excretory ducts are formed; these open into the prostatic sinus on the floor of the prostatic portion of the urethra.

Muscular Fibres — Are abundant in the fibrous capsule. The urethra is surrounded, as it passes through the prostate, by a thick layer of circular fibres continuous behind with the fibres of the sphincter vesicæ, and in front with those of the membranous portion of the urethra.

Vessels & Nerves — Arteries are derived from the internal pudic, vesical & middle hæmorrhoidal. Veins form an important plexus around sides & base of prostate: they receive in front the dorsal vein of the penis, and open behind into internal iliac vein. Lymphatics ramify on the outer surface of the capsule. Nerves are derived from hypogastric plexus.

THE MALE URETHRA.

Is about 8½ inches long, and extends from neck of bladder to end of penis.
It presents beneath the pubes a fixed curve concave superiorly, and in front of the pubes in the flaccid state of the penis, a second flexible curve concave inferiorly.
It is divided into: –

PROSTATIC PORTION — The widest & most dilatable part, spindle-shaped, 1¼ inches long; passes through the prostate from base to apex, lying nearer its upper than its lower surface. Its transverse section is of a horse-shoe shape concave inferiorly. On its floor are the following parts: –

URETHRAL CREST, VERUMONTANUM OR CAPUT GALLINAGINIS – Longitudinal elevation 8 or 9 lines in length and 1½ lines high at its central & highest part, consisting, according to Kobelt, of muscular fibres & erectile tissue. On either side of the crest is the

PROSTATIC SINUS – A longitudinal groove into which open the ducts of the lateral lobe of the prostate. On the front part of the crest is the

UTRICLE, SINUS POCULARIS OR VESICULA PROSTATICA – An expanding cul-de-sac, which passes backwards into the substance of the middle lobe of the prostate for about a quarter of an inch, and upon or within the margins of which are the slit-like openings of the ejaculatory ducts.

MEMBRANOUS PORTION —The shortest, and, excepting the meatus, the narrowest part of the canal. It extends from apex of prostate to bulb of corpus spongiosum, and is situated between the two layers of the deep perinæal fascia, which layers are prolonged around it, the one downwards & forwards, the other upwards & backwards. Its upper surface is concave superiorly, ¾ of an inch long, and situated about an inch below & behind the pubic arch, from which arch it is separated by the anterior fibres of the compressor urethræ muscle & by the dorsal vessels & nerves of the penis. Its under surface is convex inferiorly, only ½ inch long (in consequence of the bulb projecting backwards beneath the urethra), and separated from the rectum by a triangular space, broad below, narrow above, the perinæum.

SPONGY PORTION — Commences within the bulb below & behind the symphysis pubis, ascends a short distance in front of the symphysis within the corpus spongiosum, curves downwards with the latter in the flaccid state of the penis, and ends at the meatus urinarius. It is about six inches long. In the greatest part of its course it is uniform in size, and intermediate between the prostatic & membranous portions; it is dilated, however, within the bulb & within the glans penis (in which latter situation the dilatation forms the fossa navicularis), and is greatly constricted at the meatus. Its transverse section is elongated from side to side except within the glans penis, where it is elongated vertically. On its walls, and more particularly on its floor, are the openings of numerous mucous glands, the glands of Littre, which openings are directed forwards, and are sometimes large enough to intercept the passage of small catheters; this is especially the case with one of them, which is situated on the upper wall of the fossa navicularis, and which constitutes the lacuna magna. On the floor of its posterior dilated portion comprised within the bulb, and sometimes termed the bulbous portion, are the openings of the ducts of Cowper's glands.

STRUCTURE — Three coats: –

Mucous Coat – Thin, pale in the prostatic portion, rosy in the membranous & spongy portions, in which it is thrown into longitudinal folds (except when the canal is distended with urine). Covered with columnar epithelium except in the fossa navicularis, where the epithelium is squamous. Presents the glands of Littre above described, which glands are most abundant in the spongy portion, and presents also, near the meatus, a few papillæ.

Muscular Coat – Consists of external longitudinal & internal circular unstriped muscular fibres, both most abundant in the prostatic portion.

Erectile Coat – Thick in the spongy portion, where it forms the corpus spongiosum (Vide Structure of the Penis). From this a thin layer of erectile tissue is prolonged upwards round the membranous & prostatic portions as far as the neck of the bladder, forming in the prostatic portion, according to Kobelt, the verumontanum or caput gallinaginis.

STRUCTURE of the PENIS.

CORPORA CAVERNOSA — Arise from the anterior & inner part of the two ischiat tuberosities, and from the ascending rami of the ischia & descending rami of the pubes, by two pointed prolongations, the *crura penis*. These pass forwards & inwards, present a slight enlargement, the *bulb of the corpus cavernosum*, and unite to form the body of the penis. – The body of the penis presents on its upper surface a narrow median groove for the dorsal vessels & nerves of the organ, and, on its under surface a broader groove, which receives the corpus spongiosum. It ends anteriorly in a rounded extremity overlapped by the base of the glans.

CORPUS SPONGIOSUM — Commences between the two converging crura of the corpora cavernosa by an expanded portion, the *bulb of the urethra*. This latter is penetrated superiorly by the membranous portion of the urethra, is marked inferiorly by a partial division into two lobes, and is surrounded by the accelerator urinæ muscle & by a prolongation of the anterior or descending layer of the deep perinæal fascia. – It passes forwards, as an erectile tube, round the spongy portion of the urethra, and terminates in the *glans penis*, a conical enlargement, which overlaps the anterior rounded extremity of the two corpora cavernosa.

STRUCTURE of the CORPORA CAVERNOSA & SPONGIOSUM — They consist of:

Fibrous Investment – Thick, dense, firm, especially over the corpora cavernosa, highly elastic, but incapable of more than a certain degree of distention; formed of white & yellow elastic fibrous tissues and of unstriped muscular fibres disposed longitudinally in the superficial strata, circularly in the deeper ones.

It forms but an incomplete septum between the two corpora cavernosa in their points of contact: – The septum is thick & imperforate behind, but it only consists in front of a few vertical bands arranged somewhat like the teeth of a comb, and forming the *septum pectiniforme*.

It gives off numerous trabeculæ from its inner surface. – In the corpora cavernosa the trabeculæ are strongest towards the periphery, and the compartments they bound are transversely or circularly disposed & largest towards the centre. In the corpus spongiosum the trabeculæ are more delicate, and the compartments are longitudinal & more uniform, except in the glans penis where their arrangement is somewhat complex.

Erectile Tissue – Consists of afferent arteries, a venous plexus, & efferent veins.

Afferent Arteries – Are the arteries of the corpora cavernosa & the arteries of the bulb, and twigs from the internal pudic & the dorsal arteries of the penis. Some of the branches of these arteries terminate in capillary plexuses as in other parts of the body. Others, the *helicine arteries*, which are said to be especially numerous towards the root of the penis and to be wanting in the glans, become convoluted, and forming tendril-like twigs, project singly or in tufts into the venous spaces, and end in dilated extremities which are either open or closed (Müller). This is denied however by Valentin, who describes the smallest branches of the arteries as ending in wide funnel-shaped orifices, which open directly into the venous spaces.

Venous Plexus – Is very intricate. So numerous & large are the communications between the veins that the blood appears to be effused into a system of extra-vascular structures.

Efferent Veins – Some emerge from the corona glandis and from the upper & under surfaces of the corpora cavernosa, and join the dorsal vein of the penis; most pass out at the root of the penis, and join the prostatic plexus & the pudic veins.

The proper nerves of the cavernous structures are derived mainly from the pelvic & prostatic plexuses of the sympathetic, but partly also from the pudic nerve.

INTERNAL ILIAC ARTERY.

Short thick trunk which extends from bifurcation of common iliac artery opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) to upper border of great sacro-sciatic foramen, near which it divides into anterior & posterior divisions.

Usually 1½ inches long, but its length may vary from ½ an inch to 3 inches.

Rather smaller in adult than the external iliac. Twice as large in fœtus: – Under the name of hypogastric artery, it then continues the common iliac along side of bladder, and ascends to umbilicus where it becomes one of the umbilical arteries.

RELATIONS:

In Front – Peritoneum, ureter.
Behind – Pyriformis, internal iliac vein, lumbo-sacral cord.
On Outer Side near Origin – Psoas & external iliac vein.

BRANCHES — Are given off as follows, from: –

ANT. DIVISION — Sup. Middle & Inf. Vesical, Middle Hæmorrhoidal, and in female, Uterine & Vaginal; Obturator, Sciatic, Pudic.

POST. DIVISION — Ilio-Lumbar, Lateral Sacral, Gluteal.

BRANCHES of the INTERNAL ILIAC ARTERY—1st T.

BRANCHES FROM ANTERIOR DIVISION.

VISCERAL BRANCHES:

Vesical – Two or three; but other twigs pass to bladder from middle hæmorrhoidal, uterine, vaginal, & obturator.

Superior Vesical – Is that part of hypogastric artery which extends to side of bladder, and which remains pervious after birth. Gives off *artery of vas deferens*, and the

Middle Vesical, – Which is often wanting.

Inferior Vesical – Usually arises in common with middle hæmorrhoidal. To base of bladder, prostate, & vesiculæ seminales.

Middle Hæmorrhoidal – Joins with superior hæmorrhoidal branch of inferior mesenteric, and with inferior hæmorrhoidal branch of internal pudic.

Uterine – Downwards to neck of uterus, and then upwards in a tortuous course along side of body between folds of broad ligament; communicates with ovarian.

Vaginal – Descends upon vagina to neck of bladder & rectum.

NON-VISCERAL BRANCHES:

Obturator – Usually arises (2 cases out of 3) from anterior division or sometimes from posterior division of internal iliac. In one case in 3½ it arises from the epigastric, that is to say that its anastomotic branch with that artery is enormously increased in size while its proper root is proportionately diminished. Sometimes both roots are nearly equally developed (1 case in 72). Occasionally the artery arises from termination of external iliac.

In cases of abnormal origin from epigastric the obturator artery usually arises from near the root of the latter, and then descends into the pelvis close to the external iliac vein and on the outer side of the femoral ring. Sometimes, however, it arises from the epigastric higher up, that is to say at a distance from the root of the latter; it then passes inwards above the femoral ring and descends into the pelvis on the inner side of that ring behind Gimberat's ligament. It is in this latter case only that the obturator artery is exposed to be wounded in the operation for strangulated femoral hernia.

When it arises from the internal iliac it passes forwards along outer wall of pelvis below obturator nerve, giving off small iliac & vesical branches and a pubic branch which communicates on back of pubes with its fellow and with the epigastric.

Through upper part of obturator foramen, and divides into:

Internal Br. – Round inner margin of obturator foramen; supplies obturator & adductor muscles, pectineus & gracilis and anastomoses with internal circumflex.

External Br. – Round outer margin of obturator foramen to interval between gemellus inferior & quadratus femoris, sends an articular branch to hip-joint through cotyloid notch, and anastomoses with external circumflex & sciatic arteries; supplies obturator externus & the lower external rotator muscles.

Sciatic – The largest of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.

Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.

Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.

With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus

Gives off branches:

Muscular, Articular to hip-joint;

Coccygeal, Inferior Gluteal;

Comes Nervi Ischiadici – Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh

Pudic – Vide next Tablet.

BRANCHES of the INTERNAL ILIAC ARTERY—2nd T.

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

BRANCHES:

Inferior Hæmorrhoidal – Two or three, small. – Arise in ischio-rectal fossa, which they cross to lower part of rectum & anus.

Superficial Perinæal – Arises near transversus perinæi muscle, which it crosses superficially.
Between accelerator urinæ & erector penis to skin of scrotum & dartos, or of labium.

Transverse Perinæal – Small, arises frequently from superficial perinæal.
Inwards below transversus perinæi to structures between bulb and anus.

Artery of the Bulb – Large and surgically important.
Inwards to bulb & Cowper's glands between the two layers of deep perinæal fascia.
May be small or even absent, or may be double. May arise earlier and cross perinæum further back than usual, and would then be very liable to be divided in lateral lithotomy. May arise from an accessory pudic, and then lie more forward and be altogether out of danger.

Artery of the Corpus Cavernosum – Pierces crus penis, and runs forwards in corpus cavernosum by side of septum pectiniforme.

Dorsal Artery of the Penis – Between crus and symphysis. Through suspensory ligament and forwards beneath skin on dorsum of penis to glans & prepuce.

ACCESSORY PUDIC ARTERY — Exceptional branch of internal iliac, which exists when pudic artery, being smaller than usual, fails to give off its two terminal branches & sometimes even the artery of the bulb.
Arises from near origin of pudic, passes forwards along base of bladder & upper part of prostate, pierces triangular ligament, and takes the place of terminal portion of normal artery.

BRANCHES of the INTERNAL ILIAC ARTERY—3rd T.

BRANCHES FROM POSTERIOR DIVISION.

Ilio-Lumbar – Arises from upper part of posterior division.
Ascends beneath psoas to upper part of iliac fossa, where it divides into:

LUMBAR BRANCH – To psoas & quadratus lumborum, communicating with last lumbar artery, and sending a small spinal branch through intervertebral foramen between last lumbar vertebra & sacrum;
ILIAC BRANCH – To iliacus & ilium, and along crest anastomosing with circumflex iliac.

Lateral Sacral – Usually two, superior & inferior.
Downwards and inwards in front of pyriformis & sacral plexus, and along inner side of anterior sacral foramina, anastomosing with middle sacral and giving off

DORSAL BRANCHES – Through anterior sacral foramina to contents of spinal canal, and then through posterior sacral foramina to skin & muscles on back of sacrum.

Gluteal – The largest branch of internal iliac, and the continuation of its posterior division.
Through great sacro-sciatic foramen above pyriformis, and then between latter muscle & gluteus medius, and divides into:

SUPERFICIAL BRANCH – Gives off numerous branches to gluteus maximus & integument over sacrum;
DEEP BRANCH – Forwards between glutei medius & minimus, and divides into:
Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.
Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branches of external circumflex.

SACRAL PLEXUS.

Formed by lumbo-sacral cord & anterior divisions of the three first sacral nerves, and part of that of the fourth.

Triangular in shape, – its constituent nerve-fibres converging to form one broad flat cord, which leaves pelvis through lower part of great sacro-sciatic foramen below pyriformis, and immediately divides into Small sciatic, Great sciatic & Pudic.

Rests upon pyriformis, and is covered by the pelvic fascia & by the two terminal branches (sciatic & pudic) of anterior division of internal iliac artery.

BRANCHES :

Superior Gluteal – From back of lumbo-sacral cord.

With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:

Superior Branch – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus.

Inferior Branch – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

Muscular – To pyriformis, obturator internus, gemelli & quadratus femoris. – The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle. – The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint.

Small Sciatic – From lower & back part of sacral plexus.

With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.

Descends beneath gluteus maximus on inner side of great sciatic nerve.

Along back of thigh beneath fascia lata to lower part of popliteal space.

Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve. Gives off branches:

Inferior Gluteal – Several, large; to under surface of gluteus maximus.

Inferior Pudendal – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.

Cutaneous – *Descending.* To skin of inner & outer sides of back of thigh, popliteal space and back of leg.

Ascending. Wind round lower border of gluteus maximus to integument over its surface.

Great Sciatic – Vide p. 78.

Pudic – Vide pp. 107 & 293.

HEAD & NECK.

II.

POSTERIOR TRIANGLE OF THE NECK.

POSTERIOR TRIANGLE of the NECK.

Is bounded by sterno-mastoid, trapezius & clavicle.
Its floor is formed from above downwards by splenius capitis, levator anguli scapulæ, posterior & middle scaleni, and superior digitation of serratus magnus; – a part of the complexus is sometimes seen above the splenius.
It is divided by posterior belly of omo-hyoid into:

Sup. or Occipital Portion – The largest, contains:
Superficial cervical plexus & spinal accessory nerve,
Transversalis colli artery & vein,
Fat & lymphatic glands.

Inf. or Clavicular Portion – The smallest. Its size varies greatly with the extent of clavicular attachments of sterno-mastoid & trapezius, situation of omo-hyoid, and elevated or depressed position of shoulder. Contains:
Third part of subclavian artery,
Brachial plexus,
Transversalis humeri & transversalis colli vessels,
External jugular vein,
Fat & lymphatic glands.

MUSCLES.

Platysma Myoides – Clavicle, acromion, fascia over pectoralis major, deltoid, & trapezius.

Innermost fibres decussate below chin & in front of symphysis; others are inserted into lower jaw below external oblique line; others blend with depressores labii inferioris & anguli oris and the other muscles of the mouth, forming risorius. – S. by superficial cervical plexus and facial nerve.

Sterno-Cleido-Mastoid or Sterno-Mastoid.

Sternal Portion – Upper & outer part of front of first piece of sternum.

Clavicular Portion – Anterior surface & upper border of inner third of clavicle.

Anterior border & outer surface of mastoid process and outer two-thirds of superior curved line of occipital bone. – S. by deep external branches of cervical plexus & by spinal accessory nerve.

Trapezius – External occipital protuberance & inner third of superior curved line of occipital bone; ligamentum nuchæ & spinous processes of the last cervical & of all the dorsal vertebræ; supraspinous ligament.

Posterior border of outer third of clavicle, inner border of acromion; whole length of upper lip of posterior border of spine of scapula, and tubercle at outer part of smooth surface at its inner extremity. – S. by spinal accessory nerve & deep branches of cervical plexus.

Levator Anguli Scapulæ – Posterior tubercles of transverse processes of the 3, 4, or 5 upper cervical vertebræ between splenius and scalenus medius.

Posterior border of scapula between spine and superior angle. – S. by one of the deep branches of the cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Splenius – Lower half of ligamentum nuchæ and spinous processes of 7th cervical & six upper dorsal vertebræ.

Splenius Capitis – Mastoid process and outer part of rough surface between superior & inferior curved lines of occipital bone.

Splenius Colli – Posterior tubercles of transverse processes of the 2, 3, or 4 upper cervical vertebræ – S. by external branches of posterior divisions of cervical nerves.

Scalenus Anticus – Tubercule on inner border and upper surface of 1st rib.

Anterior tubercules of transverse processes of 3rd, 4th, 5th, and 6th cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

Scalenus Medius – Upper surface of first rib behind groove for subclavian artery.

Posterior tubercles of transverse processes of six lower cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

Scalenus Posticus – Back of outer surface of 2nd rib.

Posterior tubercules of transverse processes of two or three lower cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

CERVICAL PLEXUS.

Formed by anterior branches of four upper cervical nerves & loops connecting them, and lies beneath sterno-mastoid, in front of levator anguli scapulæ & scalenus medius & the four upper vertebræ.
Communicates through loop between 4th & 5th nerves with brachial plexus, and, through its deep communicating branches, with pneumogastric, spinal accessory, hypoglossal & superior cervical ganglion of the sympathetic. – Its superficial branches communicate with facial & great occipital.
Its branches are superficial & deep.

SUPERFICIAL BRANCHES — Wind round posterior border of sterno-mastoid one below the other in the following order, which is also the order in which they arise.

Small Occipital – From 2nd cervical; variable in size & sometimes double.
Ascends behind sterno-mastoid to attollens aurem & posterior belly of occipito-frontalis, and perforates deep fascia to integument of back of side of head & upper part of back of pinna; its auricular branches being sometimes supplied by great occipital. Joins with great occipital, great auricular, & posterior auricular branch of facial. – The second small occipital, or smallest occipital, when it exists, arises from 3rd nerve, and sends twigs to back of neck.

Great Auricular – From 2nd & 3rd cervical nerves.
Ascends upon sterno-mastoid & beneath platysma to near lobule of ear, where it divides into branches:
Auricular – Several, large; to integument of back of pinna, joining with posterior auricular branches of facial & pneumogastric. Some twigs supply outer surface of lobule, and one reaches outer surface of pinna through a fissure between antihelix & concha.
Mastoid – To integument behind ear, joining with post. auricular branch of facial.
Facial – To integument of face, and to parotid gland joining with facial.

Superficial Cervical – The largest; from 2nd & 3rd.
Crosses sterno-mastoid beneath platysma & external jugular vein, and divides into brs.:
Ascending – Gives off an ascending twig to external jugular vein, joins with cervico-facial branch of facial, and, supplying platysma, pierces it to integument of upper & front part of neck.
Descending – Pierces platysma to integument of lower & front part of neck.

Superficial Descending – Several large branches from 3rd & 4th.
Descend between sterno-mastoid & trapezius, and divide into branches:
Sternal – Cross origin of sterno-mastoid to integument of front of chest as far as middle line.
Clavicular – Cross clavicle (sometimes one of them perforates the bone) to integument over pectoralis major & deltoid, communicating with cutaneous branches of the superior intercostal nerves.
Acromial – Over acromion & clavicular origin of trapezius to integument of outer & back part of shoulder.

SPINAL ACCESSORY NERVE.

Consists of two portions, the portion accessory to the pneumogastric & the spinal portion.

PORTION ACCESSORY to the PNEUMOGASTRIC — The smaller.

Arises from *lateral tract of medulla oblongata below pneumogastric.* — Deep origin from grey nucleus on lower part of floor of 4th ventricle.

Joins ganglion of root of pneumogastric in jugular foramen by two or three filaments, and is entirely added to the pneumogastric below the ganglion of the trunk.

Assists in forming *pharyngeal, superior & inferior laryngeal brs.* of pneumogastric.

SPINAL PORTION — The larger.

Arises from *lateral column of cord as low as 5th or 6th cervical n.* — Deep origin from anterior horn of grey matter.

Ascends between ligamentum denticulatum & posterior roots of the spinal ns., and enters skull through foramen magnum.

Passes out through jugular foramen in same sheath as, and on outer side of, pneumogastric n. and behind glosso-pharyngeal, joining with accessory portion.

Backwards behind hypoglossal & pneumogastric, beneath and then behind internal jugular vein and digastric & stylo-hyoid muscles to upper part of sterno-mastoid.

Pierces deep fibres of sterno-mastoid, giving branches to it and joining in its substance with 3rd cervical nerve.

Crosses posterior triangle of the neck, joining with 2nd, 3rd, 4th & 5th cervical ns., and is distributed to under surface of trapezius.

SUBCLAVIAN ARTERY.

From innominate artery behind upper border of sterno-clavicular articulation (right side), from end of transverse portion of arch of Aorta (left side), to outer border of first rib. Divided into three parts: –

FIRST PART — From origin to inner border of scalenus anticus.

SECOND PART — Lies behind scalenus anticus at a somewhat variable level above clavicle. Short; forms higest part of arch described by the artery. – RELATIONS:

In Front – Scalenus anticus, subclavian vein, phrenic nerve.
Behind – Scalenus medius.
Above – Brachial plexus.
Below – Pleura.

SUBCLAVIAN VEIN lies below & in front of artery, from which it is separated by scalenus anticus.

BRANCHES — **Superior Intercostal** on right side; generally no branch on left side.

THIRD PART — From outer border of scalenus anticus to outer border of first rib. Crosses lower & inner part of posterior triangle of neck, lying in the small space bounded by omo-hyoid, clavicle & scalenus ant. – RELATIONS:

In front – Skin, superficial fascia, platysma, descending branches of superficial cervical plexus, deep fascia, transversalis colli vein. Clavicle, subclavius & its nerve, transversalis humeri vessels, external jugular vein with the plexus frequently formed by the suprascapular & transversalis colli.
Behind – Scalenus medius.
Above – Brachial plexus, omo-hyoid.
Below – Outer surface of first rib.

SUBCLAVIAN VEIN lies below, in front, & to inner side of artery.

BRANCH — Frequently the **Posterior Scapular**, which is otherwise derived from the transversalis colli.

THYROID AXIS.

Short thick trunk from front of first part of subclavian close to inner border of scalenus anticus. Divides almost immediately into :-

Inferior Thyroid - Vide p. 293.

Suprascapular or Transversalis Humeri

Crosses lower part of scalenus anticus under cover of sterno-mastoid.
Outwards behind clavicle, beneath omo-hyoid.
Beneath trapezius, and over transverse ligament of scapula to supraspinous fossa, where it ramifies between the muscle & the bone.
Crosses neck of scapula to infraspinous fossa. - Anastomoses with the other scapular arteries, supplies shoulder-joint & subscapularis, and gives off a small supra-acromial twig.

Transversalis Colli

Crosses upper part of subclavian triangle in front of scaleni & brachial plexus, passing sometimes between the trunks of the plexus, and divides beneath trapezius into :

SUPERFICIAL CERVICAL - Ascends beneath trapezius to muscles & glands of back of neck, and anastomoses with superficial branch of arteria princeps cervicis.

POSTERIOR SCAPULAR - Beneath levator anguli scapulæ to superior angle of scapula, and then along posterior border of the bone beneath rhomboidei as far as its inferior angle, anastomosing with the other scapular arteries & the intercostals. Frequently arises from 3rd part of subclavian.

BRACHIAL PLEXUS.

Formed as follows by anterior divisions of 5th, 6th, 7th, & 8th cervical and 1st dorsal ns.:
Fifth & Sixth Cervical unite between anterior & middle scaleni, and form the OUTER PRIMARY CORD.
Eighth & First Dorsal unite behind scalenus anticus, and form the INNER
Seventh forms alone the MIDDLE PRIMARY CORD. [PRIMARY CORD.
All three primary cords divide into *anterior & posterior divisions.*
Anterior divisions of *outer & middle* primary cords form the OUTER CORD.
Anterior division of *inner* primary cord forms the INNER CORD.
Posterior divisions of *all three* primary cords form the POSTERIOR CORD.

Broad between anterior & middle scaleni, where anterior divisions of the nerves lie above 2nd part of subclavian artery; contracted opposite clavicle, where inner & outer cords lie at fore part of plexus on outer side of 3rd part of subclavian artery & of 1st part of axillary; again expanded in axilla, where the three cords lie on inner, outer & posterior aspects of 2nd part of axillary, and where they break up into the large nerves of upper limb.

Communicates with the cervical plexus through loop between 4th & 5th nerves & through branch from 5th nerve to phrenic, and with middle & inferior ganglia of sympathetic.

BRANCHES — Are

ABOVE THE CLAVICLE:

Post. or Long Thoracic, or Ext. Respiratory of Sir C. Bell – From 5th & 6th nerves, the two roots uniting in substance of scalenus medius.
Deeply along side of chest behind axillary vessels & cords of brachial plexus as far as lowest digitation of serratus magnus.

Suprascapular – From back of trunk formed by union of 5th & 6th.
Backwards & outwards beneath trapezius & through suprascapular foramen to supraspinous fossa, where lies between supraspinatus & the bone.
Round spine of scapula to infraspinous fossa. – Supplies supra- & infraspinati (two twigs to each), shoulder-joint & scapula.

Muscular – To rhomboidei & frequently to levator anguli scapulæ (from 5th nerve), subclavius (from 5th & 6th, anastomoses frequently with phrenic), scaleni & longus colli (variably from 6th 7th & 8th.)

Communicating – From 5th cervical to phrenic on anterior scalenus.

BELOW THE CLAVICLE — The branches are given off from the three cords as follows, from:

Outer Cord – External anterior thoracic, outer head of median, musculo-cutaneous or external cutaneous.
Inner Cord – Internal anterior thoracic, inner head of median, ulnar, internal cutaneous, lesser internal cutaneous or n. of Wrisberg.
Posterior Cord – The three subscapular nerves, musculo-spiral & circumflex.

HEAD & NECK.

II.

ANTERIOR TRIANGLE OF THE NECK.

ANTERIOR TRIANGLE of the NECK.

Is bounded by sterno-mastoid, middle line of neck, lower border of jaw & line from angle of jaw to mastoid process.
It is divided by anterior belly of omo-hyoid, and by stylo-hyoid & posterior belly of digastric into:

Inf. Carotid Triangle – Bounded by sterno-mastoid, anterior belly of omo-hyoid, & middle line of neck; contains beneath sterno-hyoid & -thyroid:
Common carotid artery, internal jugular vein, pneumogastric & sympathetic;
Inferior thyroid artery, recurrent laryngeal nerve;
Trachea, thyroid gland, lower part of larynx.

Sup. Carotid Triangle – Bounded by sterno-mastoid, anterior belly of omo-hyoid, stylo-hyoid & posterior belly of digastric; contains:
Termination of common carotid artery, internal & external carotid arteries, & first branches of the latter;
Superior thyroid, lingual, facial, & internal jugular veins;
Pneumogastric, superior laryngeal, & sympathetic nerves:
Hypoglossal & descendens noni nerves.
Upper part of larynx, lower part of pharynx.

Submaxillary Triangle – Bounded by median line, jaw-bone & line from angle of jaw to mastoid process, and by stylo-hyoid & posterior belly of digastric; contains:
Submaxillary gland, facial artery & vein;
Submental artery, mylo-hyoid artery & nerve;
Lower part of parotid gland, facial nerve, external carotid artery with its posterior auricular, temporal & internal maxillary branches;
Internal carotid, internal jugular vein, pneumogastric, sympathetic all separated from external carotid by stylo-glossus & -pharyngeus & glosso-pharyngeal n.

MUSCLES.

INFRA-HYOID REGION.

Sterno-Hyoid or Sterno-Cleido-Hyoid – Variously from posterior sterno-clavicular ligament, and from upper & back part of first piece of sternum or back of inner extremity of clavicle, or from both; sometimes from clavicle only; occasionally from cartilage of first rib.
Lower border of body of hyoid bone internally to omo-hyoid. – S. by a branch from loop between descendens & communicans noni nerves.

Sterno-Thyroid – Back of first piece of sternum below & internally to sterno-hyoid.
Oblique line on ala of thyroid cartilage. – S. by a branch from same source.

Omo-Hyoid – Upper border of scapula on inner side of suprascapular notch and sometimes from transverse ligament.
Lower border of body of hyoid bone externally to sterno-hyoid. – S. by a branch from loop between descendens & communicans noni nerves.

Thyro-Hyoid – Oblique line on ala of thyroid cartilage.
Lower border of body & greater cornu of hyoid bone. – S. by hypoglossal n.

SUPRA-HYOID REGION.

Digastric – Digastric groove on inner side of mastoid process. – Perforates stylo-hyoid and is held in connection with body & great cornu of hyoid bone by an aponeurotic loop lined with synovial membrane, from which loop it is reflected upwards & forwards to
Rough depression on inner lip of lower border of jaw bone close to symphysis. – S., posterior belly by facial nerve, anterior belly by mylo-hyoid branch of inferior dental nerve.

Stylo-Hyoid – Middle of outer surface of styloid process.
Body of hyoid bone at its junction with great cornu. – S. by facial nerve.

Mylo-Hyoid – Whole length of mylo-hyoid ridge.
Body of hyoid bone & median raphé from hyoid bone to symphysis. – S. mylo-hyoid branch of inferior dental nerve.

Genio-Hyoid – Inferior genial tubercle.
Anterior surface of body of hyoid bone. – S. by hypoglossal nerve.

COMMON CAROTID ARTERY.

Right common carotid arises from innominate artery behind steno-clavicular articulation.
Left common carotid arises from highest part of arch of Aorta, is longer, and has a thoracic portion deeply situated within the thorax.

THORACIC PORTION OF THE LEFT COMMON CAROTID ART.

Upwards & outwards to root of neck. — RELATIONS:
In Front — Sternum, sterno-hyoid & -thyroid, left innominate v., remains of thymus gland.
Behind — Trachea, œsophagus, thoracic duct.
On Inner Side — Innominate artery.
On Outer Side — Left pneumogastric & phrenic ns. & left subclavian art., left lung & pleura.

CERVICAL PORTION OF THE COMMON CAROTID ARTERIES.

Upwards & outwards from behind sterno-clavicular articulation to upper border of thyroid cartilage, where divides into external & internal carotid arts.
Direction from sternal end of clavicle to midway between angle of jaw & mastoid pr.
In same sheath of deep cervical fascia as int. jugular v. & pneumogastric n. Deeply situated at origin; superficial at termination. — RELATIONS:
In Front, *Lower part* — Skin, superf. f., platysma, ant. jugular v., deep f.; Sterno-mastoid, -hyoid, -thyroid, omo-hyoid, middle thyr. v.
Upper part — Skin, superf. f. platysma, deep f., inner border of sterno-mastoid.
Sterno-mastoid art., facial, lingual & sup. thyroid veins, descendens noni n.
Behind — Cervical vertebræ, longus colli, rectus capitis anticus major, inf. thyroid artery, sympathetic & recurrent laryngeal ns.
On Inner Side — Trachea, thyroid gland, larynx, pharynx; inferior thyroid art., recurrent laryngeal n.
On Outer Side — Internal jugular vein, pneumogastric n. — At lower part of neck int. jugular v. diverges from artery on right side, approaches and crosses it on left side.

EXTERNAL CAROTID ARTERY.

From upper border of thyroid cartilage to interval between neck of condyle & external auditory meatus, where divides into temporal & internal maxillary.
At its origin it is more superficial & nearer middle line than int. carotid. — RELATIONS:
Covered by — Skin, superficial f., platysma, deep f., ant. border of sterno-mastoid; Lingual & facial veins, hypoglossal n., digastric & stylo-hyoid ms. Parotid gl., facial n., junction of temporal & internal maxillary vs.
On Inner Side — Wall of pharynx, portion of parotid gland, sup. laryngeal n.
Behind — Sup. laryngeal n., stylo-glossus & -pharyngeus, glosso-pharyngeal n., internal carotid art.

BRANCHES: Superior Thyroid, Lingual, Facial; Occipital, Post. Auricular; — Ascending Pharyngeal; Temporal, Int. Maxillary.

ANTERIOR BRANCHES of the EXTERNAL CAROTID.

SUP. THYROID — Arises from front of external carotid close to its origin beneath thin anterior margin of sterno-mastoid, and is quite superficial when this muscle is dissected from its sheath, for the latter then retracts and exposes the carotid vessels & their branches.

Tortuous course upwards & forwards, and then downwards & forwards beneath omo- & sterno-hyoid & -thyroid to anterior surface of thyroid body. Gives off brs:

Hyoid – Small; along lower border of hyoid bone beneath thyro-hyoid, and joins with its fellow.

Sterno-Mastoid or Superficial Descending – Descends to middle of sterno-mastoid, crossing carotid vessels.

Sup. Laryngeal – With superior laryngeal nerve to interior of larynx through outer part of thyro-hyoid membrane.

Crico-Thyroid – Small; crosses crico-thyroid membrane and joins with its fellow.

LINGUAL — Arises a little below hyoid bone beneath thin anterior margin of sterno-mastoid.

Upwards & forwards upon middle constrictor to great cornu of hyoid bone.

Horizontally forwards above great cornu beneath hyo-glossus, digastric & stylo-hyoid.

Upwards on genio--hyo-glossus.

Forwards with gustatory nerve on under surface of lingualis inferior, and then beneath mucous membrane to tip of tongue under name of ranine. – Gives off brs:

Hyoid – Small; along upper border of hyoid bone and joins with its fellow.

Dorsalis Linguæ – Ascends on genio--hyo-glossus to dorsum of tongue, epiglottis, soft palate & tonsil.

Sublingual – Forwards between mylo-hyoid & mucous membrane to sublingual gland.

Ranine – The terminal branch; joins with its fellow at tip of tongue.

FACIAL — Arises above preceding beneath thin anterior margin of sterno-mastoid.

Forwards & upwards beneath posterior belly of digastric & stylo-hyoid & submaxillary gld.

Crosses jaw bone in front of masseter.

Forwards and upwards to angle of mouth upon buccinator & beneath platysma.

Upwards beneath zygomatici and upon levator anguli oris and the levators of the lip & ala of the nose to inner canthus, where becomes angular artery and joins with ophthalmic.

Is very tortuous in its course. Facial vein lies behind it, and is less tortuous. Gives off branches:

Inferior or Ascending Palatine – Dips beneath ramus of jaw. Ascends between stylo-glossus & -pharyngeus and then upon superior constrictor in front of ascending pharyngeal, and supplies tonsil & soft palate.

Tonsillar – Ascends upon and perforates sup. constrictor to tonsil & root of tongue.

Submaxillary – Three or four, to submaxillary gland & surrounding muscles.

Submental – Forwards on under surface of mylo-hyoid, and between it and digastric to symphysis, where ascends upon chin.

Inf. Labial – Forwards beneath depressor anguli oris, below following artery to tissues of lower lip.

Inf. Coronary – Forwards beneath depressor anguli oris, and tortuous course through substance of orbicularis and between it & mucous membrane, anastomosing with its fellow.

Sup. Coronary – Larger and more tortuous; similar course along free edge of upper lip, giving twigs to ala and artery of septum to septum of nose.

Lateralis Nasi – To ala and dorsum of nose.

Angular – To inner canthus, supplying lachrymal sac and anastomosing with nasal branch of ophthalmic.

All these branches anastomose freely with each other, with those of the opposite side, and with the mental, transverse facial, infra-orbital, ophthalmic, sublingual, posterior superior or descending palatine and ascending pharyngeal arteries.

POSTERIOR BRANCHES of the EXTERNAL CAROTID.

OCCIPITAL — Arises just below posterior belly of digastric, and is crossed close to its origin by hypoglossal nerve.

Upwards and backwards beneath posterior belly of digastric, stylo-hyoid, & portion of parotid gland, crossing internal carotid artery, internal jugular vein, glosso-pharyngeal, pneumogastric & spinal accessory nerves, – and then between mastoid process & transverse process of atlas.

Horizontally backwards in occipital groove beneath sterno-mastoid, digastric, splenius & trachelo-mastoid, – and then between trapezius & complexus.

Pierces upper part of trapezius, ascends beneath integument with great occipital nerve, and divides into numerous branches to upper & back part of head.

Gives off branches:

Muscular – Numerous small ones, and one large one to upper part of sterno-mastoid.

Auricular – To back of ear.

Meningeal – Through jugular foramen to dura mater of posterior fossa.

Arteria Princeps Cervicis – Descends beneath splenius, and divides into:

Superficial Br. – Descends between splenius & complexus, and anastomoses with superficial cervical branch of transversalis colli.

Deep Br. – Descends beneath complexus, and anastomoses with vertebral & with deep cervical branch of superior intercostal.

POST. AURICULAR — Arises beneath or above digastric & stylo-hyoid, and ascends under cover of parotid gland & beneath facial nerve to groove between cartilage of ear and mastoid process, where divides into

Ant. & Post. Branches – Which communicate respectively with posterior branch of temporal & with occipital, and of which the former gives off numerous branches to back of ear. – Gives off

Stylo-mastoid Art. (Sometimes derived from occipital). – Through stylo-mastoid foramen to tympanum & semicircular canals, joining with tympanic branch of internal maxillary, with which it forms in young subjects a vascular circle round membrana tympani.

INTERNAL BRANCH of the EXTERNAL CAROTID.

ASCENDING PHARYNGEAL — Long, slender; from back of external carotid near its origin.

Ascends vertically to base of skull, in front of internal carotid artery and between that vessel & side of pharynx, giving off branches:

External – Small, irregular, to 8th, 9th, and sympathetic nerves, and adjoining muscles.

Pharyngeal – Three or four; to the three constrictors, stylo-pharyngeus, Eustachian tube, soft palate & tonsil.

Meningeal – To dura mater through foramina lacera posterius & medium, and sometimes through anterior condyloid foramen

VEINS of HEAD & NECK—1st Tablet.

ANTERIOR JUGULAR VEIN — Commences in submaxillary region and descends beneath platysma between sterno-mastoid & middle line of neck, and then deeply beneath sterno-mastoid, beneath which muscle it communicates with external & internal jugulars, and usually also with its fellow by a long & narrow transverse branch. Ends usually in subclavian close to external jugular, sometimes in terminal portion of external jugular. Receives

LATERAL TRIBUTARY BRANCHES: – A few *laryngeal veins* & sometimes an *inferior thyroid vein.* – Varies greatly in size, and is frequently absent on one side or other.

EXTERNAL JUGULAR VEIN — Formed by coalescence of temporal, internal maxillary, & posterior auricular, and commences in substance of parotid gland opposite angle of jaw. Descends perpendicularly over sterno-mastoid & along its posterior border, beneath platysma & over superficial cervical n., and, perforating deep fascia, opens into subclavian externally to internal jugular. Has two pairs of valves situated, one at its opening into subclavian, the other about an inch & a half above clavicle. – Receives

LATERAL TRIBUTARY BRANCHES : – *Suprascapular, Transversalis Colli, & Posterior External Jugular,* sometimes the *Occipital;* – and communicates with the anterior & internal jugulars, with the latter by a large branch in substance of parotid.

INTERNAL JUGULAR VEIN – The continuation of lateral sinus opposite jugular foramen, in which foramen it is expanded into the *gulf or sinus of the internal jugular vein.* Descends vertically, lying first on outer side of & a little behind internal carotid, then on outer side of common carotid, and finally, on the left side, on outer side & in front of common carotid, and, on the right side, externally to & at a certain distance from it, in front of first part of subclavian. The eighth & ninth nerves lie on inner side & in front of its sinus; lower down the spinal accessory crosses the vein posteriorly, and the glosso-pharyngeal & hypoglossal pass forwards on its inner side, between it and the internal carotid; the pneumogastric lies along whole of neck between & behind the two vessels; behind the vein are the recti capitis lateralis, anticus major, & the longus colli. – Joins subclavian behind sterno-clavicular articulation to form the innominate, a pair of valves being situated at or a little above its termination. – Receives

LATERAL TRIBUTARY BRANCHES : – *Occipital* (usually), *Facial, Lingual, Pharyngeal, Superior & Middle Thyroid;* – and communicates by a large branch with external jugular in substance of parotid.

CERVICAL PLEXUS.

DEEP BRANCHES — Divided into internal & external.

INTERNAL — Are:

Communicating – From loop between 1st & 2nd cervical to pneumogastric, hypoglossal & superior cervical ganglion of sympathetic; and also from 3rd & 4th to cord of sympathetic below the ganglion.

Muscular – From 1st & 2nd, to recti capitis antici major & minor, and rectus lateralis.

Communicans Noni – From 2nd & 3rd.
Downwards & forwards across sheath of carotid vessels (sometimes within the sheath, and then either in front of or behind internal jugular vein), and, near middle of neck, forms a loop with descendens noni; from convexity of which loop branches are given off to the sterno-hyoid & -thyroid and omo-hyoid.

Phrenic or Int. Respiratory of Sir C. Bell – From 3rd, 4th, and usually also from 5th.
Downwards & inwards in front of scalenus anticus.
Between subclavian vein & 1st part of subclavian artery crossing internal mammary, and receiving a filament from sympathetic, sometimes another from 5th & 6th cervical nerves, and occasionally on the left side, one from the ansa hypoglossi.
Crosses arch of Aorta & pulmonary artery, on the left side.
Descends, on the right side, on outer side of right innominate vein & sup. vena cava.
In front of root of lung & along side of pericardium to diaphragm, and divides in to branches which perforate the diaphragm and supply it by its under surface.
Both nerves give off twigs to the pericardium & pleura, and join with the phrenic plexus of the sympathetic, the right nerve sending also a few filaments to the diaphragmatic ganglion.

EXTERNAL — Are:

Communicating – Join spinal accessory in substance of sterno-mastoid, in occipital triangle, & beneath trapezius.

Muscular – To sterno-mastoid (from 2nd nerve), levator anguli scapulæ (from 3rd), scalenus medius & trapezius (from 3rd & 4th)

PNEUMOGASTRIC NERVE.

Arises from lateral tract of medulla oblongata below glosso-pharyngeal & above spinal accessory. — Its deep origin is from a grey nucleus on floor of fourth ventricle.

Through jugular foramen behind glosso-pharyngeal & in same sheath as spinal accessory.

Presents two ganglia, one in and one below jugular foramen:

SUP. OR JUGULAR G. OR G. OF THE ROOT — Small, greyish, rounded. Anastom. with *facial, glosso-pharyngeal, spinal accessory & sympathetic.*

INF. G. OR G. OF THE TRUNK — Reddish, cylindrical, nearly an inch in length. Anastom. with *hypoglossal, spinal accessory, sympathetic, loop between two first cervical nerves.*

Descends behind & between int. & comm. carotid arteries & int. jugular v. and in same sheath; Then,

ON RIGHT SIDE:

Between subclavian art. & v. and along side of trachea to back of root of lung, where spreads out into posterior pulmonary plexus.

Along side of œsophagus in the shape of two or more separate cords, which form œsophageal plexus with nerve of opposite side.

As a single cord along back of œsophagus to posterior surface of stomach, and joins solar & splenic plexuses.

ON LEFT SIDE:

Between and in front of left comm. carotid & left subclavian arteries behind left innominate vein.

Across arch of aorta to back of root of lung, where similarly spreads out and joins with its fellow.

Along side of œsophagus as above.

As a single cord along front of œsophagus to anterior surface of stomach, and joins left hepatic plexus.

BRANCHES:

Auricular Br. — Arises from g. of the root, and joins with glosso-pharyngeal.
Across jugular fossa & through opening in temporal bone near styloid process; Between mastoid process & ext. audit. meatus to integument of back of pinna.
Gives off:
ASCENDING BR., which joins trunk of facial in aqueductus Fallopii;
DESCENDING BR., which joins auricular branch of facial.

Pharyngeal Br. — Arises from upper part of ganglion of the trunk;
Crosses internal carotid art. either in front or behind;
Anast. with glosso-pharyngeal, sup. laryngeal & sympathetic, and forms pharyngeal plexus to muscles & mucous membrane of pharynx.

Sup. Laryngeal N. — Arises from middle of ganglion of the trunk.
Descends by side of pharynx behind int. carotid artery, and divides into:
EXT. LARYNGEAL BR. — Joins with pharyngeal plexus & sup. cardiac nerve, and supplies crico-thyroid & inf. constrictor.
INT. LARYNGEAL BR. — Pierces thyro-hyoid membrane to arytenoid muscle and mucous membrane of larynx, base of tongue & aryteno-epiglottidean folds.

Recurr. Laryngeal N. — Ar. in front of, and passes below & behind, subclav. art. on right side, arch of aorta, on left, giving twigs to deep cardiac plexus;
Behind comm. carotid & inf. thyroid arteries, and in groove between trachea & œsophagus.
Beneath inf. constrictor to all the muscles of the larynx except crico-thyroid.
Gives brs. to inf. constrictor, and anastomoses with ext. laryngeal.

Cardiac Brs. — Divided into:
CERVICAL CARDIAC, THORACIC CARDIAC } Vide Nerves of the Heart.

Pulmonary Brs. — Divided into ANTERIOR and POSTERIOR, and form the ant. & post. pulmonary plexuses. (Vide nerves of the lung.)

Œsophageal Brs. — Arise, some above, but most of them below, the pulmonary.

Gastric Brs. — Right pneumogastric supplies post. aspect of stomach and joins solar & splenic plexuses; left pneumog. supplies ant. aspect, and joins left hepatic plexus.

HYPOGLOSSAL NERVE.

Arises by ten or twelve filaments from *groove between anterior pyramid & olivary body* in a line continuous with that of the anterior roots of the spinal nerves. These filaments form two bundles which perforate dura mater separately, and pass together through anterior condyloid foramen. — Its deep origin is from a grey nucleus on lower part of floor of 4th ventricle.

Passes downwards and forwards between pneumogastric & spinal accessory ns., with former of which it is intimately connected, and between int. jugular vein & int. carotid.

Loops round occipital artery and passes forwards across external carotid below post. belly of digastric.

Passes beneath posterior belly of digastric & stylo-hyoid and crosses hyo-glossus, near ant. border of which it anastomoses with gustatory.

Passes beneath mylo-hyoid to muscles & substance of the tongue.

BRS. OF COMMUNICATION — Join with:

G. of the trunk of the pneumogastric;
Sup. cervical g. of the sympathetic;
Loop between the two first cervical ns.
} Arise near base of skull.

Gustatory n. — Arises near ant. border of hyo-glossus.

BRS. OF DISTRIBUTION — Are the:

Descendens Noni — Long & slender. Arises just beneath occipital artery. Passes downwards & forwards across sheath of carotid vessels. (Sometimes within the sheath, either over or beneath int. jugular vein). Near middle of neck forms a loop with Communicans Noni, from convexity of which loop, brs. are given off to sterno-hyoid & thyroid and omo-hyoid.

This br. is believed to derive its real origin principally from the 1st & 3rd cervical ns., and to have little more than an apparent origin from the hypoglossal, due to a temporary adhesion of its fibres to those of that nerve. Sometimes, owing to similar adhesions, it appears to arise from the pneumogastric either wholly or in part.

Brs. to Thyro-hyoid & Genio-hyoid — Arise on surface of hyo-glossus.

Brs. to Stylo-glossus, Hyo-glossus, Genio-hyo-glossus & substance of the tongue. — Arise beneath milo-hyoid.

CERVICAL PORTION of the SYMPATHETIC.

Consists on each side of three ganglia, the superior, middle & inferior cervical (of which the middle one is sometimes wanting), and of their respective branches of communication & distribution.

THE THREE GANGLIA:

Superior Cervical Ganglion – The *largest,* usually fusiform in shape and situated between the rectus capitis anticus major & the internal carotid *opposite the 2nd & 3rd cervical vertebræ;* sometimes irregular in shape & situated a little lower than usual.

Middle Cervical Ganglion – When present, is the *smallest* of the three and is situated *opposite the 5th cervical vertebra* in the vicinity of the inferior thyroid artery.

Inferior Cervical Ganglion – *Intermediate in size* between the two others, and situated *between the neck of the first rib & the transverse process of the last cervical vertebra* on inner side of superior intercostal artery; is irregular in form, and is frequently joined with the first thoracic ganglion.

THEIR COMMUNICATIONS:

These ganglia communicate *with each other* through the main cord of the sympathetic, and with the cerebro-spinal nerves as follows:

SUPERIOR CERVICAL GANGLION — With:
- *Petrosal Ganglion of the Glosso-pharyngeal;*
- *Both Ganglia of the Pneumogastric;*
- *Trunk of the Hypoglossal;*
- *Four upper Cervical Nerves* – (Sometimes with the two upper nerves only, the branches of communication with the 3rd & 4th nerves occasionally joining the cord of the sympathetic a little below the ganglion).

MIDDLE CERVICAL GANGLION — With:
- *Fifth & Sixth Cervicol Nerves* – (In case of absence of the middle cervical ganglion the 5th & 6th cervical nerves join with the cord of the sympathetic between the superior & inferior ganglia.

INFERIOR CERVICAL GANGLION — With:
- *Seventh & Eighth Cervical Nerves.*

THEIR BRANCHES OF DISTRIBUTION — Vide next Tablet.

BRS. of DISTRIB. of the CERV. G. of the SYMPATHETIC.

These ganglia give off branches to the neighbouring arteries and to the viscera as follows:

BRS. to the NEIGHBOURING ARTERIES:

SUP. CERVICAL GANGLION — Gives off:

ASCENDING BRANCH TO INTERNAL CAROTID ARTERY & ITS BRANCHES — Large, soft, of a reddish grey colour, and appears to be the direct continuation of the ganglion. It passes along the posterior aspect of internal carotid artery and divides on reaching the carotid canal into internal & external branches.

INTERNAL BRANCH – The smaller; ascends on inner side of internal carotid artery, communicating with the outer branch, and goes to form the greater part of the cavernous plexus.

EXTERNAL BRANCH – The larger; ascends on outer side of internal carotid artery, communicating with the inner branch, and goes to form the greater part of the carotid plexus.

ANTERIOR BRANCHES TO EXTERNAL CAROTID ARTERY & ITS BRANCHES — Form *delicate plexuses which accompany the external carotid artery & its branches*, and on the filaments of which small ganglia are sometimes found. – From the plexus on the trunk of the external carotid artery a communicating branch is given off to the digastric branch of the facial nerve; from the plexus on the facial artery is derived the sympathetic root of the submaxillary ganglion; from the plexus on the internal maxillary artery is derived the sympathetic root of the otic ganglion and also a twig to the intumescentia gangliformis of the facial.

MIDDLE CERVICAL GANGLION — Gives off:

THYROID BRANCHES — Accompany the inferior thyroid artery, communicating with superior cardiac nerve, and reach the thyroid body, in which they communicate with the recurrent & external laryngeal nerves.

INF. CERVICAL GANGLION — Gives off:

BRANCHES TO VERTEBRAL ARTERY — Form a plexus round that vessel, and communicate with the cervical nerves as high as the 4th.

BRS. to the VISCERA — Are the:

Cardiac Nerves - Vide Next Tablet.

Pharyngeal Branches of the Superior Cervical Ganglion - Join with the pharyngeal branches of the *glosso-pharyngeal, pneumogastric, & external laryngeal* to form the pharyngeal plexus, which plexus supplies the muscles & the mucous membrane of the pharynx.

Thyroid Branches of the Middle Cervical Ganglion - Vide above.

HEAD & NECK.

III.

THE FACE.

MUSCLES of the FACE—1st Tablet.

Are the:

OCCIPITO-FRONTALIS.

Frontal Portion – Innermost fibres are continuous with pyramidalis nasi, the others blend with orbicularis palpebrarum & corrugator supercilii.

Occipital Portion – Outer two-thirds of superior curved line of occipital bone, and mastoid portion of temporal.

The intervening epicranial aponeurosis is attached behind, between the two occipital portions, to the external occipital protuberance & to the superior curved lines; laterally it gives attachment to the attrahens & attollens aurem, and, becoming considerably thinned, passes over the temporal fascia to the zygoma. – It is intimately connected to the integument, loosely to the pericranium.

S., frontal portion by facial nerve, occipital portion by small occipital branch of cervical plexus & by auricular branch of facial.

MUSCLES of the EAR.

Attollens Aurem, or Auricularis Superior – Temporal portion of epicranial aponeurosis.

Upper and anterior part of helix & upper part of concha. – S. by small occipital branch of cervical plexus.

Attrahens Aurem, or Auricularis Anterior – Lateral prolongation of epicranial aponeurosis below & in front of preceding.

Front part of helix. – S. by facial nerve.

Retrahens Aurem, or Auricularis Posterior – Mastoid process.

Back of concha – S. by auricular branch of facial.

MUSCLES of the NOSE.

MUSCLES of the EYELIDS & ORBIT.

MUSCLES of the MOUTH.

ELEVATOR MUSCLES of the LOWER JAW — Vide following Tablets.

MUSCLES of the FACE—2nd Tablet.

MUSCLES OF THE NOSE.

Pyramidalis Nasi – Continuous superiorly with innermost fibres of occipito-frontalis.
Aponeurosis of compressor nasi.

Compressor Nasi – Lower & inner part of canine fosa.
Aponeurosis continuous with that of its fellow over bridge of nose.

Levator Labii Superioris Alæque Nasi – Upper part of nasal process of superior maxilla.
Cartilage of ala of nose and upper lip blending with orbicularis & levator labii superioris proprius.

Depressor Alæ Nasi – Myrtiform fossa or incisor fossa of upper jaw.
Septum and back part of ala of nose.

Irregular and indistinct fasciculi may be found over the alar cartilages forming the:
Levator Proprius Alæ Nasi Posterior or Dilatator Naris Posterior,
Levator Proprius Alæ Nasi Anterior or Dilatator Naris Anterior,
Compressor Narium Minor.

MUSCLES OF THE EYELIDS.

Orbicularis Palpebrarum – Anterior surface and edges of tendo oculi, internal angular process of frontal, nasal process of superior maxilla in front of lachrymal groove.

Orbicular Portion – Thick & red, forms complete ellipses, and blends superiorly with occipito-frontalis and corrugator supercilii.

Palpebral or Ciliary Portion – Thin & pale, forms a series of concentric curves, and is inserted externally into external tarsal ligament & malar bone.

TENDO OCULI OR TENDO PALPEBRARUM – From nasal process of superior maxilla in front of lachrymal groove. Crosses anterior aspect of lachrymal sac, giving off a fibrous lamina, the reflected portion of the tendo oculi, which passes backwards & inwards behind lachrymal sac to be attached to ridge on lachrymal bone. Bifurcates and is attached to inner extremity of each tarsal cartilage.

Corrugator Supercilii – Inner extremity of superciliary ridge of frontal.
Under surface of orbicularis & occipito-frontalis.

Tensor Tarsi – Ridge & posterior part of outer surface of lachrymal bone.
Crosses posterior aspect of lachrymal sac, and divides into two slips which are inserted into tarsal cartilages near puncta lachrymalia. – May be considered as a deep part of ciliary portion of orbicularis.

Levator Palpebræ Superioris – Under surface of lesser wing of sphenoid in front of optic foramen and externally to superior oblique.
Upper border of tarsal cartilage.

MUSCLES of the FACE—3rd Tablet.

MUSCLES of the MOUTH.

Orbicularis Oris – Consists of three portions:

Labial or Marginal Portion – Continued uninterruptedly from one lip to the other round the commissures of the mouth.

Facial Portion – Central fibres decussate with, the others are directly continuous with, fibres of buccinator.

Accessory Portion – Consists for the upper lip of four fasciculi, the musculi accessorii orbicularis superiores, arising from superior maxilla opposite incisor teeth & from septum of the nose; and for lower lip, of two fasciculi, the musculi accessorii orbicularis inferiores, from inferior maxilla near the canine teeth.

Inserted into this muscle and into the integument covering it from the middle of the upper lip to the middle of the lower lip, are the following muscles (the last excepted), which all blend more or less with each other: –

Levator Labii Superioris Alæque Nasi – Upper part of nasal process of superior maxilla.

Levator Proprius Labii Superioris – Superior maxillary & malar bones close to margin of orbit.

Levator Anguli Oris or Musculus Caninus – Canine fossa just below infra-orbital foramen.

Zygomaticus Minor – Lower and front part of malar bone.

Zygomaticus Major – Malar bone near zygomatic suture.

Buccinator – Outer surface of alveolar processes of superior & inferior maxillæ corresponding to the molar teeth, and from pterygo-maxillary ligament (which latter is a fibrous band extending from apex of internal pterygoid plate to posterior extremity of mylo-hyoid ridge of lower jaw, and which gives attachment posteriorly to superior constrictor of pharynx).

Its fibres are continuous with those of facial portion of orbicularis oris, the middle ones decussating, the superior & inferior ones passing directly into corresponding lip.

Risorius – Fascia over parotid gland & masseter. – Is often described as the upper part of platysma myoides.

Depressor Anguli Oris or Triangularis Oris – External oblique line of lower jaw externally to mental foramen.

Depressor Labii Inferioris or Quadratus Menti – External oblique line of lower jaw between symphysis & mental foramen.

Levator Labii Inferioris or Levator Menti – Incisor fossa of lower jaw.

Integument of chin close to median line.

FACIAL ARTERY.

Arises above lingual beneath thin anterior margin of sterno-mastoid.
Forwards & upwards beneath posterior belly of digastric & stylo-hyoid & submaxillary gld.
Crosses jaw bone in front of masseter.
Forwards and upwards to angle of mouth upon buccinator & beneath platysma.
Upwards beneath zygomatici and upon levator anguli oris and the levators of the lip & ala of the nose to inner canthus, where becomes angular artery and joins with ophthalmic.
Is very tortuous in its course. Facial vein lies behind it, and is less tortuous. Gives off branches:

Inferior or Ascending Palatine – Dips beneath ramus of jaw. Ascends between stylo-glossus & -pharyngeus and then upon superior constrictor in front of ascending pharyngeal, and supplies tonsil & soft palate.

Tonsillar – Ascends upon and perforates sup. constrictor to tonsil & root of tongue.

Submaxillary – Three or four, to submaxillary gland & surrounding muscles.

Submental – Forwards on under surface of mylo-hyoid, and between it and digastric to symphysis, where ascends upon chin.

Inf. Labial – Forwards beneath depressor anguli oris, below following artery to tissues of lower lip.

Inf. Coronary – Forwards beneath depressor anguli oris, and tortuous course through substance of orbicularis and between it & mucous membrane, anastomosing with its fellow.

Sup. Coronary – Larger and more tortuous; similar course along free edge of upper lip, giving twigs to ala and artery of septum to septum of nose.

Lateralis Nasi – To ala and dorsum of nose.

Angular – To inner canthus, supplying lachrymal sac and anastomosing with nasal branch of ophthalmic.

All these branches anastomose freely with each other, with those of the opposite side, and with the mental, transverse facial, infra-orbital, ophthalmic, sublingual, posterior superior or descending palatine and ascending pharyngeal arteries.

TEMPORAL ARTERY.

Commences in substance of parotid gland between neck of condyle & external auditory meatus.

Ascends in groove between condyle & external auditory meatus, and crosses posterior root of zygoma.

Ascends for about two inches upon temporal muscle & fascia, and beneath skin & attrahens aurem, with branches of facial & auriculo-temporal nerves, and divides into:

Ant. Temporal – The smaller. Forwards over forehead, and joins with supraorbital & frontal.

Post. Temporal – The larger. Upwards & backwards, and joins with posterior auricular & occipital.

Gives off before its division:

Twigs – To parotid gland & temporo-maxillary articulation.

Transverse Facial – Forwards through parotid gland, and across face between Steno's duct & zygoma; joins with facial & infraorbital.

Middle Temporal – Through temporal fascia to temporal muscle, joining with deep temporal branches of internal maxillary. Often gives off

Orbital Branch – To outer angle of orbit along upper border of zygoma & between the two layers of temporal fascia.

Ant. Auricular – Two or three small branches to external ear.

FACIAL N. or PORTIO DURA of the 7th PAIR.

Arises from *upper part of lateral tract of medulla oblongata in groove between olivary & restiform bodies.* — Its deep origin is from a grey nucleus on floor of 4th ventricle & from nucleus of motor root of 5th nerve, and also, by its accessory portion or portio intermedia of Wrisberg, from lateral column of cord.

Through internal auditory meatus with portio mollis, lying in a groove upon the latter and portio intermedia of Wrisberg lying between the two.

Through aqueductus Fallopii, in which runs outwards, backwards, downwards:

Outwards – between cochlea and vestibule to hiatus Fallopii, where presents geniculate ganglion or intumescentia gangliformis.

Backwards – in inner wall of tympanum above fenestra ovalis.

Downwards – to stylo-mastoid foramen.

Forwards in substance of parotid gland crossing external carotid artery, and divides behind ramus of jaw into temporo-facial & cervico-facial branches, forming pes anserinus.

Its branches may be divided into branches of communication & branches of distribution.

BRANCHES OF COMMUNICATION — Are:

In Meatus Auditorius Internus:

One or two filaments to Auditory N.

In Aqueductus Falloppii:

Large Petrosal N. – to Meckel's ganglion, and supplies *levator palati & azygos uvulæ;*
Small Petrosal N. – to Otic ganglion, and supplies *tensor palati & tensor tympani;*
Ext. Petrosal N. – to sympathetic on middle meningeal artery.

After Exit from Stylo-mastoid Foramen:

Branches to: Glosso-pharyngeal, Pneumogastric & Carotid Plexus – Arise from posterior auricular nerve & from nerves to stylo-hyoid & posterior belly of digastric.

Auriculo-temporal – From temporo-facial branch.
Great Auricular – From posterior auricular & cervico-facial branches.

On the Face:

The terminal filaments join with the three divisions of the Fifth N.

BRANCHES OF DISTRIBUTION — Are:

In Aqueductus Fallopii:

TYMPANIC BR. – To *stapedius & laxator tympani;*
CHORDA TYMPANI – Enters tymp. between membr. tympani & base of pyramid; Between handle of malleus & long process of incus.
Through canal of Huguier on inner side of Glaserian fissure;
Joins gustatory nerve between the two pterygoid muscles;
To submaxillary ganglion & lingualis superior.

After Exit from Stylo-mastoid Foramen:

POST. AURICULAR N. – Over mastoid process to integument and retrahens aurem & posterior belly of occipito-frontalis, and anastomoses with auricularis magnus & posterior auricular branch of pneumogastric.

BRS. to STYLO-HYOID & POST. BELLY of DIGASTRIC – Arise in common, and join, the former with carotid plexus, the latter with glosso-pharyngeal.

On the Face:

TEMPORO-FACIAL BR. – The larger. Anastomoses with auriculo-temporal, and divides into *temporal, malar & infraorbital branches.*

CERVICO-FACIAL – The smaller. Anastomoses with great auricular, and divides into *buccal, supramaxillary & inframaxillary branches*

These terminal branches of the facial nerve supply all the muscles of expression of the face & the platysma, and anastomose with the ophthalmic, superior & inferior maxillary nerves and with the great auricular

THE SALIVARY GLANDS—1st Tablet.

Are the parotid, submaxillary & sublingual, and numerous smaller glands situated beneath the mucous membrane of the mouth. They are all conglomerate or racemose glands.

PAROTID GLAND

Lies below & in front of external ear, and stretches forwards to a variable extent on outer surface of masseter, often presenting in that situation and just below zygoma, a small detached portion, the socia parotidis.

Is bounded by:

ABOVE – Zygoma.

BELOW – Line drawn from angle of jaw to sterno-mastoid.

BEHIND – External auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Presents:

OUTER SURFACE – Lobulated. Covered by integument, fascia & a few fibres of platysma.

INNER SURFACE – Prolonged deeply in front of and behind styloid process towards internal carotid & internal jugular vein, wall of pharynx & deep part of glenoid fossa.

ANT. SURFACE – Grooved externally for posterior border of ramus, and prolonged forwards, internally, between the two pterygoid muscles.

POST. SURFACE – Rests upon external auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Is perforated by several

ARTERIES – *External carotid* with its *posterior auricular*, *internal maxillary* & *temporal* branches, and the *transverse facial* offset of the latter.

VEINS – *Internal maxillary & temporal* forming origin of *external jugular*, and a *branch of communication* between the latter & the internal jugular.

NERVES – *Facial*, *auriculo-temporal* & deep facial branches of *great auricular*.

ITS VESSELS & NERVES are — ARTERIES & VEINS, from or to above mentioned trunks. – LYMPHATICS, to two or three lymphatic glands in substance & on surface of parotid, and from thence to superficial & deep glands of neck. – NERVES, from carotid plexus, auriculo-temporal & great auricular.

PAROTID DUCT (Steno's or Stenson's) — From anterior border of the gland, and from socia parotidis when it exists. Over masseter a finger's breadth below zygoma, its direction being marked by a line from lower part of concha to midway between free margin of the lip & ala of the nose. Through fat of cheek & buccinator, and obliquely beneath mucous membrane, which it perforates opposite 2nd molar tooth of upper jaw.

HEAD & NECK.

IV.

PTERYGO-MAXILLARY REGION.

THE SALIVARY GLANDS—1st Tablet.

Are the parotid, submaxillary & sublingual, and numerous smaller glands situated beneath the mucous membrane of the mouth. They are all conglomerate or racemose glands.

PAROTID GLAND

Lies below & in front of external ear, and stretches forwards to a variable extent on outer surface of masseter, often presenting in that situation and just below zygoma, a small detached portion, the socia parotidis.

Is bounded by:

ABOVE – Zygoma.

BELOW – Line drawn from angle of jaw to sterno-mastoid.

BEHIND – External auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Presents:

OUTER SURFACE – Lobulated. Covered by integument, fascia & a few fibres of platysma.

INNER SURFACE – Prolonged deeply in front of and behind styloid process towards internal carotid & internal jugular vein, wall of pharynx & deep part of glenoid fossa.

ANT. SURFACE – Grooved externally for posterior border of ramus, and prolonged forwards, internally, between the two pterygoid muscles.

POST. SURFACE – Rests upon external auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Is perforated by several

ARTERIES – *External carotid* with its *posterior auricular*, *internal maxillary* & *temporal* branches, and the *transverse facial* offset of the latter.

VEINS – *Internal maxillary* & *temporal* forming origin of *external jugular*, and a *branch of communication* between the latter & the internal jugular.

NERVES – *Facial*, *auriculo-temporal* & deep facial branches of *great auricular*.

ITS VESSELS & NERVES are — ARTERIES & VEINS, from or to above mentioned trunks. – LYMPHATICS, to two or three lymphatic glands in substance & on surface of parotid, and from thence to superficial & deep glands of neck. – NERVES, from carotid plexus, auriculo-temporal & great auricular.

PAROTID DUCT (Steno's or Stenson's) — From anterior border of the gland, and from socia parotidis when it exists. Over masseter a finger's breadth below zygoma, its direction being marked by a line from lower part of concha to midway between free margin of the lip & ala of the nose. Through fat of cheek & buccinator, and obliquely beneath mucous membrane, which it perforates opposite 2nd molar tooth of upper jaw.

FACIAL N. or PORTIO DURA of the 7th PAIR.

Arises from *upper part of lateral tract of medulla oblongata in groove between olivary & restiform bodies.* — Its deep origin is from a grey nucleus on floor of 4th ventricle & from nucleus of motor root of 5th nerve, and also, by its accessory portion or portio intermedia of Wrisberg, from lateral column of cord.

Through internal auditory meatus with portio mollis, lying in a groove upon the latter and portio intermedia of Wrisberg lying between tha two.

Through aqueductus Fallopii, in which runs outwards, backwards, downwards:

Outwards – between cochlea and vestibule to hiatus Fallopii, where presents geniculate ganglion or intumescentia gangliformis.

Backwards – in inner wall of tympanum above fenestra ovalis.

Downwards – to stylo-mastoid foramen.

Forwards in substance of parotid gland crossing external carotid artery, and divides behind ramus of jaw into temporo-facial & cervico-facial branches, forming pes anserinus.

Its branches may be divided into branches of communication & branches of distribution.

BRANCHES OF COMMUNICATION — Are:

In Meatus Auditorius Internus:

One or two filaments to Auditory N.

In Aqueductus Fallopii:

Large Petrosal N. – to Meckel's ganglion, and supplies *levator palati & azygos uvulæ;*
Small Petrosal N. – to Otic ganglion, and supplies *tensor palati & tensor tympani,*
Ext. Petrosal N. – to sympathetic on middle meningeal artery.

After Exit from Stylo-mastoid Foramen:

Branches to: Glosso-pharyngeal, Pneumogastric & Carotid Plexus – Arise from posterior auricular nerve & from nerves to stylo-hyoid & posterior belly of digastric.

Auriculo-temporal – From temporo-facial branch.
Great Auricular – From posterior auricular & cervico-facial branches.

On the Face:

The terminal filaments join with the three divisions of the Fifth N.

BRANCHES OF DISTRIBUTION — Are:

In Aqueductus Fallopii:

TYMPANIC BR. – To *stapedius & laxator tympani;*
CHORDA TYMPANI – Enters tymp. between membr. tympani & base of pyramid;
Between handle of malleus & long process of incus.
Through canal of Huguier on inner side of Glaserian fissure;
Joins gustatory nerve between the two pterygoid muscles;
To submaxillary ganglion & lingualis superior.

After Exit from Stylo-mastoid Foramen:

POST. AURICULAR N. – Over mastoid process to integument and retrahens aurem & posterior belly of occipito-frontalis, and anastomoses with auricularis magnus & posterior auricular branch of pneumogastric.

BRS. to STYLO-HYOID & POST. BELLY of DIGASTRIC – Arise in common, and join, the former with carotid plexus, the latter with glosso-pharyngeal.

On the Face:

TEMPORO-FACIAL BR. – The larger. Anastomoses with auriculo-temporal, and divides into *temporal, malar & infraorbital branches.*

CERVICO-FACIAL – The smaller. Anastomoses with great auricular, and divides into *buccal, supramaxillary & inframaxillary branches*

These terminal branches of the facial nerve supply all the muscles of expression of the face & the platysma, and anastomose with the ophthalmic, superior & inferior maxillary nerves and with the great auricular

MUSCLES of the FACE—5th Tablet.

ELEVATOR MUSCLES of the LOWER JAW.

Masseter.

Superficial Portion – Anterior two-thirds of lower border of zygomatic arch.

Angle & lower half of outer surface of ramus.

Deep Portion – Posterior third of lower border & inner surface of zygomatic arch.

Upper half of outer surface of ramus & coronoid process. – S. by anterior or smaller division of inferior maxillary nerve.

Temporal – Whole extent of temporal fossa, except anterior wall, inner surface of temporal fascia.

Apex, inner surface & anterior border of coronoid process down to its root. – S. by anterior or smaller division of inferior maxillary nerve.

Internal Pterygoid – Pterygoid fossa, and more particularly from inner surface of external pterygoid plate, and from groove on pterygoid process of palate bone.

Angle and inner surface of ramus as high as dental foramen. – S. by anterior or smaller division of inferior maxillary nerve.

External Pterygoid.

Upper Head – Pterygoid ridge & portion of under surface of great wing of sphenoid between it and base of pterygoid process.

Lower Head – Outer surface of external pterygoid plate & tuberosity of superior maxillary and palate bones.

Depression on front of neck of condyle & interarticular fibro-cartilage of temporo-maxillary articulation. – S. by anterior or smaller division of inferior maxillary nerve.

TEMPORO-MAXILLARY ARTICULATION.

Is a double or bilateral condyloid articulation (Cruveilhier) comprised between the condyles of the lower jaw, on the one hand, and the anterior root of the zygoma & anterior part of the glenoid cavity, on the other. The articulation is divided into two by an interarticular fibrocartilage, and presents two synovial membranes, of which the upper one is the largest & loosest. The interarticular fibrocartilage is thickest at the periphery, especially behind; its upper surface is concavo-convex from before backwards; its under surface is concave; its circumference is connected externally to the external lateral ligament, internally & in front to the tendon of the external pterygoid. – Occasionally it is perforated in the centre, the two synovial membranes then communicating.

LIGAMENTS – Are:

Capsular – Thin & loose; from
Circumference of glenoid cavity & eminentia articularis to
Neck of Condyle

External Lateral – Broad band downwards & backwards from
Outer surface & tubercle of zygoma to
Outer surface & posterior border of neck of condyle.

Internal Lateral – Long & thin band from
Spine of sphenoid to
Inner margin of dental foramen. – It is related externally the to external pterygoid muscle, internal maxillary artery, and inferior dental vessels & nerve.

Stylo-Maxillary – Long thin band of somewhat secondary importance from
Apex of styloid process to
Angle & posterior border of ramus of jaw, where it spreads out considerably and marks the separation between parotid & submaxillary glands.

MOVEMENTS – Are depression, elevation, projection, retraction, lateral displacement & circumduction. In slight movements of elevation & depression the condyles simply rotate on a transverse axis upon the interarticular fibrocartilages. In more extensive movements not only do the condyles rotate as above, but they also pass forwards with the interarticular fibrocartilages upon the eminentiæ articulares, the displacement being due to the laxity of the superior synovial membrane & to the action of the external lateral ligament. This displacement also takes place on the two sides alternately in the lateral or grinding movement of the jaw, and on both sides simultaneously in the projection of the jaw forwards.

INTERNAL MAXILLARY ARTERY.

Commences in substance of parotid gland behind neck of condyle.
May be divided into three portions:

FIRST or MAXILLARY PORTION — Forwards beneath tendon of external pterygoid, and between neck of condyle & internal lateral ligament of jaw, crossing inferior dental nerve.

Gives off **Tympanic, Middle meningeal, Small meningeal, Inferior dental.**

SECOND or PTERYGOID PORTION — Forwards & upwards on outer surface of external pterygoid, between it & temporal muscle.

Gives off **two Deep temporal, Masseteric, Pterygoid, & Buccal.**

THIRD or SPHENO-MAXILLARY PORTION — Into spheno-maxillary fossa between the two heads of external pterygoid.

Gives off **Alveolar, Infraorbital, Vidian, Pterygo-palatine, Sup. or descending palatine, Nasal or Spheno-palatine.**

Sometimes the artery passes behind, and along inner surface of, external pterygoid muscle, between it & internal pterygoid.

BRANCHES of the INTERNAL MAXILLARY.

Tympanic – Through Glaserian fissure to tympanum, where joins with stylo-mastoid.

Middle or Great Meningeal – Through foramen spinosum, and divides into:
ANTERIOR BRANCH – Across great wing of sphenoid to groove or canal on anterior inferior angle of parietal, and divides into numerous branches to dura mater & skull.
POSTERIOR BRANCH – Crosses squamous portion of temporal bone, and divides into similar branches. Gives twigs to facial nerve through hiatus Fallopii, which twigs join with stylo-mastoid.

Small Meningeal – Arises frequently from preceding; through foramen ovale to dura mater of middle fossa.

Inferior Dental – With inferior dental nerve, similarly dividing opposite first bicuspid tooth into *incisor & mental branches*, and likewise giving off
Mylo-hyoid branch – Along mylo-hyoid groove to mylo-hyoid muscle.

Deep Temporal – Two, anterior and posterior. Ascend between temporal muscle & pericranium.

Pterygoid – Vary in number and precise mode of origin.

Masseteric – Through sigmoid notch to masseter.

Buccal – Forwards upon buccinator to structures of cheek, joining with facial.

Alveolar – Descends upon tuberosity of superior maxilla, and divides into numerous branches to molar teeth, gums & lining membrane of antrum.

Infraorbital – Through infraorbital canal with superior maxillary nerve. Sends small twigs into orbit, and others to front teeth through canals in anterior wall of antrum, and divides beneath levator labii superioris into:
Ascending branches – To inner angle of eye, where they join with nasal;
Descending branches – To upper lip; join with transverse facial, superior coronary & buccal.

Vidian – With vidian nerve through vidian canal to upper part of pharynx & Eustachian tube; gives a twig to tympanum.

Pterygo-Palatine – With pharyngeal or pterygo-palatine nerve through pterygo-palatine canal to upper part of pharynx & Eustachian tube.

Superior or Descending Palatine – Descends with anterior or great palatine nerve through posterior palatine canal, sending twigs to soft palate. Forwards in groove on hard palate, giving twigs to mucous membrane & gums, and ascends through incisor foramen to join artery of septum.

Nasal or Spheno-Palatine – Through spheno-palatine foramen with superior nasal & naso-palatine nerves, and divides into:
INTERNAL BRANCH OR ARTERY OF SEPTUM – Downwards & forwards along septum, and joins with termination of descending palatine.
EXTERNAL BRANCHES – Two or three to mucous membrane of outer wall of nose, and to ethmoidal & sphenoidal cells & Antrum.

INFERIOR MAXILLARY NERVE.

The largest of the three divisions. Both sensory & motor, its two roots uniting immediately after their exit from foramen ovale.

Divides a few lines below base of skull into:

ANTERIOR or SMALLER DIVISION — Principally motor. Divides into:

Masseteric Br. – Outwards above external pterygoid muscle and through sigmoid notch to masseter. Gives off a twig to temporo-maxillary articulation & sometimes one to temporal muscle.

Deep Temporal Brs. – Two, anterior & posterior. Outwards above external pterygoid muscle and reflected upwards at pterygoid ridge to temporal muscle. Are sometimes joined, anterior one with buccal nerve, posterior one with masseteric.

Buccal Br. – Pierces external pterygoid, and forwards on buccinator, giving filaments to temporal muscle, integument & mucous membrane.

Pterygoid Brs. – Two, to internal & external pterygoid muscles. Branch to internal pterygoid gives off motor root to otic ganglion. Branch to external pterygoid is frequently derived from buccal.

POSTERIOR or LARGER DIVISION — Sensory with a few motor fibres. Divides into:

Auriculo-temporal N. – Has generally two roots which embrace middle meningeal artery. Backwards beneath external pterygoid & neck of condyle; Upwards with temporal artery between condyle & external ear under cover of parotid gland, and divides into:

Auricular Brs. – Inferior & superior, to outer surface of pinna, joining with great auricular.

Temporal Brs. – Anterior & posterior; with branches of temporal artery to skin of temporal region & vertex.

Joins facial nerve behind neck of condyle usually by two branches; gives off sensory root of otic ganglion and filaments to parotid gland & temporo-maxillary articulation.

Gustatory or Lingual N. – Between the two pterygoid muscles, where it lies on inner side & in front of inferior dental nerve, and is joined by chorda tympani; Above deep portion of submaxillary gland & along side of tongue, crossing Wharton's duct.

Supplies mucous membrane of mouth & gums, submucous glands, conical & fungiform papillæ and mucous membrane of tongue.

Gives sensory branches to submaxillary ganglion, and anastomoses with hypoglossal nerve on anterior margin of hyo-glossus & near tip of tongue.

Inf. Dental N. – Between the two pterygoid muscles, where lies behind & on outer side of gustatory; Between ramus & internal lateral ligament of temporo-maxillary articulation to dental foramen, where gives off nerve to mylo-hyoid muscle. Along inferior dental canal, giving branches to molar & bicuspid teeth, & divides at mental foramen into:

Incisor Br. – Onwards in dental canal to canine & incisor teeth.

Mental Br. – Divides beneath depressor anguli oris into numerous branches to muscles, skin & mucous membrane of lower lip.

NERVE to MYLO-HYOID – Along groove on inner surface of ramus to under surface of mylo-hyoid & anterior belly of digastric

N. — All the terminal branches of the 5th nerve upon the face. join with facial nerve.

HEAD & NECK.

V.

SUB-MAXILLARY REGION.

MUSCLES.

Digastric – Digastric groove on inner side of mastoid process. – Perforates stylo-hyoid and is held in connection with body & great cornu of hyoid bone by an aponeurotic loop lined with synovial membrane, from which loop it is reflected upwards & forwards to
Rough depression on inner lip of lower border of jaw bone close to symphysis. – S., posterior belly by facial nerve, anterior belly by mylo-hyoid branch of inferior dental nerve.

Stylo-Hyoid – Middle of outer surface of styloid process.
Body of hyoid bone at its junction with great cornu. – S. by facial nerve.

Mylo-Hyoid – Whole length of mylo-hyoid ridge.
Body of hyoid bone & median raphé from hyoid bone to symphysis. – S. mylo-hyoid branch of inferior dental nerve.

Genio-Hyoid – Inferior genial tubercle.
Anterior surface of body of hyoid bone. – S. by hypoglossal nerve.

FACIAL ARTERY.

Arises above lingual beneath thin anterior margin of sterno-mastoid.
Forwards & upwards beneath posterior belly of digastric & stylo-hyoid & submaxillary gld.
Crosses jaw bone in front of masseter.
Forwards and upwards to angle of mouth upon buccinator & beneath platysma.
Upwards beneath zygomatici and upon levator anguli oris and the levators of the lip & ala of the nose to inner canthus, where becomes angular artery and joins with ophthalmic.
Is very tortuous in its course. Facial vein lies behind it, and is less tortuous. Gives off branches:

Inferior or Ascending Palatine – Dips beneath ramus of jaw. Ascends between stylo-glossus & -pharyngeus and then upon superior constrictor in front of ascending pharyngeal, and supplies tonsil & soft palate.

Tonsillar – Ascends upon and perforates sup. constrictor to tonsil & root of tongue.

Submaxillary – Three or four, to submaxillary gland & surrounding muscles.

Submental – Forwards on under surface of mylo-hyoid, and between it and digastric to symphysis, where ascends upon chin.

Inf. Labial – Forwards beneath depressor anguli oris, below following artery to tissues of lower lip.

Inf. Coronary – Forwards beneath depressor anguli oris, and tortuous course through substance of orbicularis and between it & mucous membrane, anastomosing with its fellow.

Sup. Coronary – Larger and more tortuous; similar course along free edge of upper lip, giving twigs to ala and artery of septum to septum of nose.

Lateralis Nasi – To ala and dorsum of nose.

Angular – To inner canthus, supplying lachrymal sac and anastomosing with nasal branch of ophthalmic.

All these branches anastomose freely with each other, with those of the opposite side, and with the mental, transverse facial, infra-orbital, ophthalmic, sublingual, posterior superior or descending palatine and ascending pharyngeal arteries.

THE SALIVARY GLANDS—2nd Tablet.

SUBMAXILLARY GLAND

Intermediate in size between parotid & sublingual. Presents two portions:

Superficial Portion – The largest.

Covered by – Skin, superficial fascia, platysma, deep fascia, body of lower jaw.
Rests upon – Stylo- & hyo-glossi & mylo-hyoid.
Separated posteriorly from parotid by – Stylo-maxillary ligament.
Grooved posteriorly & above by – Facial artery.

Deep Portion – The smallest.

Prolonged upwards forwards & inwards round Wharton's duct, between mylo-hyoid and hyo- & genio-hyo-glossi & below gustatory nerve.

WHARTON'S DUCT — Upwards forwards & inwards with deep portion of the gland on inner side of sublingual gland, and opens on summit of a small papilla on side of frænum linguæ. Is about 2 inches long, and has much thinner walls than Steno's duct; it receives a few of the ductus Riviniani.

VESSELS & NERVES – *Arteries*, from facial & lingual. – *Nerves*, from submaxillary ganglion, sympathetic & mylo-hyoid branch of inferior dental.

SUBLINGUAL GLAND

The smallest, flattened, & almond-shaped.

Projects beneath mucous membrane of floor of mouth in the shape of a firm antero-posterior crest.

Lies upon mylo-hyoid by side of frænum linguæ & in sublingual fossa of lower jaw.

Has behind it & on its inner side genio-hyo-glossus, gustatory nerve, Wharton's duct & deep portion of submaxillary gland.

DUCTUS RIVINIANI — From 8 to 20. Open most of them directly into the mouth, some into Wharton's duct. One, longer than the others, the duct of Bartholin, which is sometimes derived in part from submaxillary gland, accompanies the Whartonian duct, and opens into it or near it on floor of mouth.

VESSELS & NERVES – *Arteries*, from sublingual & submental branches of facial. – *Nerves*, from gustatory.

HYPOGLOSSAL NERVE

Arises by ten or twelve filaments from *groove between anterior pyramid & olivary body* in a line continuous with that of the anterior roots of the spinal nerves. These filaments form two bundles which perforate dura mater separately, and pass together through anterior condyloid foramen. — Its deep origin is from a grey nucleus on lower part of floor of 4th ventricle.

Passes downwards and forwards between pneumogastric & spinal accessory ns., with former of which it is intimately connected, and between int. jugular vein & int. carotid.

Loops round occipital artery and passes forwards across external carotid below post. belly of digastric.

Passes beneath posterior belly of digastric & stylo-hyoid and crosses hyo-glossus, near ant. border of which it anastomoses with gustatory.

Passes beneath mylo-hyoid to muscles & substance of the tongue.

BRS. OF COMMUNICATION — Join with:

G. of the trunk of the pneumogastric;
Sup. cervical g. of the sympathetic;
Loop between the two first cervical ns.
} Arise near base of skull.

Gustatory n. — Arises near ant. border of hyo-glossus.

BRS. OF DISTRIBUTION — Are the:

Descendens Noni — Long & slender. Arises just beneath occipital artery. Passes downwards & forwards across sheath of carotid vessels. (Sometimes within the sheath, either over or beneath int. jugular vein). Near middle of neck forms a loop with Communicans Noni, from convexity of which loop, brs. are given off to sterno-hyoid & -thyroid and omo-hyoid

This br. is believed to derive its real origin principally from the 1st & 2nd cervical ns., and to have little more than an apparent origin from the hypoglossal, due to a temporary adhesion of its fibres to those of that nerve. Sometimes, owing to similar adhesions, it appears to arise from the pneumogastric either wholly or in part.

Brs. to Thyro-hyoid & Genio-hyoid — Arise on surface of hyo-glossus.

Brs. to Stylo-glossus, Hyo-glossus, Genio-hyo-glossus & substance of the tongue. — Arise beneath mylo-hyoid.

LINGUAL or GUSTATORY NERVE.

From posterior or larger division of inferior maxillary.
Between the two pterygoid muscles, where it lies on inner side and in front of inferior dental nerve, and is joined by chorda tympani.
Above deep portion of submaxillary gland and along side of tongue, crossing Wharton's duct.
Supplies mucous membrane of mouth and gums, submucous glands, conical and fungiform papillæ and mucous membrane of tongue.
Gives sensory brancaes to submaxillary ganglion, and anastomoses with hypo-glossal nerve on anterior margin of hyo-glossus and near tip of tongue.

SUB-MAXILARY GANGLION.

Reddish grey circular body about the size of a pin's head situated between gustatory nerve & deep portion of submaxillary gland. It presents:

THREE ROOTS:

Sensory Root – From gustatory nerve by several small filaments.

Motor Root – From facial nerve through chorda tympani.

Sympathetic Root – From plexus around facial artery.

BRS. **OF DISTRIBUTION** — Five or six to mucous membrane of mouth, Wharton's duct & submaxillary gland

LINGUAL ARTERY.

Arises a little below hyoid bone beneath thin anterior margin of sterno-mastoid.
Upwards & forwards upon middle constrictor to great cornu of hyoid bone.
Horizontally forwards above great cornu beneath hyo-glossus, digastric & stylo-hyoid.
Upwards on genyo-hyo-glossus.
Forwards with gustatory nerve on under surface of lingualis inferior, and then beneath mucous membrane to tip of tongue under name of ranine. – Gives off brs:

Hyoid – Small; along upper border of hyoid bone and joins with its fellow.

Dorsalis Linguæ – Ascends on genyo-hyo-glossus to dorsum of tongue, epiglottis, soft palate & tonsil.

Sublingual – Forwards between mylo-hyoid & mucous membrane to sublingual gland.

Ranine – The terminal branch; joins with its fellow at tip of tongue.

GLOSSO-PHARYNGEAL NERVE.

The smallest of the three divisions of the 8th pair. *Arises from lateral tract of medulla oblongata above pneumogastric.* — Its deep origin is from a grey nucleus on floor of 4th ventricle.

Through anterior & inner part of jugular foramen in front of pneumogastric & spinal accessory and in a separate sheath, grooving lower border of petrous portion of temporal bone and presenting two ganglia:

Sup. or Jugular G. or G. of the Root — Small, and involves only the outer fibres;

Inf. of Petrous G. or G. of Andersch — Larger, and involves whole of fibres.

Gives off from petrous ganglion:

Tympanic branch or *Jacobson's nerve,* described below;

Anastomotic br. to *ganglion of the root & to auricular br. of the pneumogastric;*

and from a little below the ganglion:

Anastomotic br. to *facial nerve.* — This branch pierces post. belly of digastric.

Downwards & forwards in front of pneumogastric & between int. carotid & int. jugular vein.

Beneath styloid process & muscles connected with it to lower border of stylo-pharyngeus.

Curves inwards upon stylo-pharyngeus & middle constrictor.

Beneath hyo-glossus to mucous membrane of fauces & base of tongue.

BRANCHES:

Tympanic Br. or Jacobson's N. — Arises from petrous ganglion.

Ascends through small canal in petrous bone to tympanum, where divides into:

Brs. of Communication — To *carotid plexus and great & small petrosal branches of facial.*

Brs. of Distribution — To *fenestra rotunda, fenestra ovalis & mucous membrane of Eustachian tube.*

Carotid Brs. — Descend on internal carotid artery, and join pharyngeal brs. of pneumogastric, sup. laryngeal & sympathetic.

Pharyngeal Brs. — Three or four; form pharyngeal plexus by joining opposite middle constrictor with pharyngeal brs. of pneumogastric, sup. laryngeal & sympathetic.

Muscular Brs. — To stylo-pharyngeus & constrictors of pharynx.

Tonsillar Brs. — To tonsil, forming tonsillar plexus, branches of which are distributed to soft palate & fauces.

Lingual Brs. — To mucous membrane of base & side of tongue.

THE TONGUE—1st Tablet.

Presents for examination:

BASE – Connected to:

Soft palate – By anterior pillars of fauces;
Pharynx – By superior constrictors of pharynx & mucous membrane;
Epiglottis – By three folds of mucous membrane, the glosso-epiglottic ligaments;
Hyoid bone – By hyo-glossi & genio-hyo-glossi muscles.

APEX – Free.

UPPER SURFACE OR DORSUM — Rough in its anterior two-thirds, where it presents the *papillæ minimæ* or *conicæ et filiformes*, and the papillæ *mediæ* or *fungiformes*; smooth in its posterior third, or behind the papillæ *maximæ* or *circumvallatæ*, where it presents the projecting orifices of numerous mucous glands.

UNDER SURFACE — Connected to hyoid bone & lower jaw by hyo-glossi & genio-hyo-glossi muscles, and from sides of which the mucous membrane is reflected over floor of mouth to inner surface of gums, forming in front a prominent fold, the frænum linguæ.

STRUCTURE of the TONGUE

Presents for examination:

Osteo-fibrous Support – Consists of:

Hyoid Bone;
Median Fibrous Septum – Thickest behind, where it is attached to epiglottis.
Hyo-glossal Membrane – Connects under surface of tongue to hyoid bone.
To these may be added the
Thick mucous Membrane on the dorsum of the organ.

Muscular fibres – Vide next Tablet.

Mucous Membrane – Vide next Tablet but one.

Vessels & Nerves.

Arteries – *Lingual*, inferior or ascending palatine branches of *facial*, *ascending pharyngeal*.
Veins – Partly correspond to arteries, partly open into pterygoid plexus.
Lymphatics – To submaxillary glands.
Nerves – Are the:

Gustatory to mucous membrane of anterior two-thirds.
Glosso-pharyngeal to mucous membrane of posterior third & sides;
Hypoglossal to the muscles.

Internal branch of the superior laryngeal sends a few twigs to mucous membrane of base. — A few small ganglia are found (Kölliker, Remak) upon the glosso-pharyngeal and, in the sheep & calf, upon the gustatory.

THE TONGUE—2nd Tablet.

MUSCULAR FIBRES.

Form extrinsic & intrinsic muscles.

EXTRINSIC MUSCLES

Are the:

Stylo-glossus – Anterior & outer aspect of styloid process near its apex & stylo-maxillary ligament.
Side of base of tongue externally to hyo-glossus, dividing into:
LONGITUDINAL PORTION – Forwards along side of tongue, and blends with lingualis inferior in front of hyo-glossus.
TRANSVERSE PORTION – Decussates with hyo-glossus & with its fellow.

Hyo-glossus – Side of body, lesser cornu & whole length of great cornu of hyoid bone (basio-glossus, chondro-glossus, cerato-glossus).
Side of under surface of tongue between stylo-glossus & lingualis inferior.

Genio-hyo-glossus – By a short tendon from superior genial tubercle on inner surface of body of jaw-bone close to symphysis.
Whole length of under surface of tongue internally to lingualis inferior, side of pharynx, body of hyoid bone.

Palato-glossus or **Constrictor Isthmi Faucium** – Anterior surface of soft palate close to uvula.
Side of base of tongue, blending with stylo-glossus.

INTRINSIC MUSCLES

Are the:

Lingualis transversus – Median septum.
Sides, and sides of dorsum. – Forms the chief bulk of the tongue.

Lingualis Superior – Stratum of longitudinal or slightly oblique fibres thickest in front, and covering dorsum of tongue beneath the mucous membrane to which the individual fibres are attached.

Lingualis Inferior – Longitudinal band of fibres along whole length of under surface of tongue between hyo-glossus & genio-hyo-glossus.
Blends with stylo-glossus in front of hyo-glossus.

Lingualis Perpendicularis – Set of vertical or slightly oblique fibres from central part of dorsum to sides of under surface, forming curves concave upwards & outwards.

The outer parts, or cortex, of the tongue are firm, and consist mainly of longitudinal fibres; the central part, or nucleus, is softer, and consists mainly of transverse & vertical fibres intermingled with adipose tissue.

THE TONGUE—3rd Tablet.

MUCOUS MEMBRANE.

Thick & rough on anterior two-thirds of dorsum, sides, & tip; thin & smooth on posterior third of dorsum & on under surface.

Consists of a cutis or corium dense & very similar to that of the skin, and of a thick layer of squamous epithelium; and presents:

PAPILLÆ — Highly sensitive vascular projections divisible into simple and compound. The former are similar to the papillæ of the skin, and cover whole of tongue; the latter, which are themselves studded with simple papillæ, are found on rough surface only, and are divided according to their size & shape into:

Papillæ Maximæ or Circumvallatæ – From 7 to 12; situated at junction of middle & posterior thirds of dorsum, where they are arranged in two rows oblique backwards & inwards, which rows meet at foramen cœcum and form together an inverted V. They consist of a central conical projection, the base of which is free while its apex is attached, which projection is contained in a cup-shaped depression bounded itself by a prominent circular rim. – The foramen cœcum is the central depression, usually large, which lodges the central papilla, itself frequently small.

Papillæ Mediæ or Fungiformes – Club-shaped, and present narrow attached & rounded free extremities. Sparingly scattered over anterior two-thirds of dorsum, collected in greater numbers over sides & tip.

Papillæ Minimæ, or Conicæ et Filiformes – Tapering or cylindrical, closely packed over whole of rough surface, and arranged in rows which are vertical on borders & tip, and which are, on dorsum, parallel, posteriorly, to the rows of circumvallate papillæ, but, anteriorly, more directly transverse. – The simple or secondary papillæ borne by the filiform papillæ contain a few elastic fibres, and their epithelial sheaths are prolonged beyond them sometimes to the extent of forming a pencil of almost hair-like fibres.

In the fungiform & circumvallate, and probably also in the filiform papillæ, the nerves form plexuses, from which small brush-like filaments are given off to the secondary papillæ. These filaments are believed to terminate in the deep extremities of spindle-shaped nucleated bodies similar to the olfactory cells of Shultze (Billroth, Key).

GLANDS — Are:

Follicular – Aggregated on posterior third of dorsum behind papillæ circumvallatæ, and very similar to the follicular recesses of the tonsils.

Racemose – Lie beneath & in front of foregoing, and over sides & under surface of tongue. On under surface near tip they are collected into two small oblong masses first described by Blandin & Nuhn.

THE TASTE-BUDS.

Are flask-like bodies discovered by Loven & Schwalbe in the thick epithelial layer which surrounds the sides of the circumvallate papillæ of the base of the tongue, and which have also been found of late on some of the fungiform papillæ and on the epiglottis. They are pyriform in shape. Their bases rest upon the chorium. Their apices project between the superficial epithelial cells, and present a minute opening, from which a bundle of thread-like processes are seen to emerge.

They consist of modified epithelial cells, disposed perpendicularly to the surface, which cells may be divided into superficial & deep. The *superficial cells* are flattened, or ribbon-like, tapering at each end, and joined together at their sides, so as to enclose the deeper cells, as, in the flower-bud, the external scales surround the internal folioles. The *deeper cells* are spindle-shaped, enlarged in their middle, where they present a prominent nucleus, and tapering at either end. Their deeper end, which is sometimes branched, passes down into the chorium, and, it is said, becomes connected with a nerve-fibril. Their more superficial end is prolonged into one of the thread-like processes, which are seen to project from the opening of the taste-bud. The surrounding epithelial cells are flattened around the taste-buds, so as to enclose them in a sac or nest.

The taste-buds are now believed not to be connected with the sense of taste, since they are found on the epiglottis, which is not endowed with taste.

HEAD & NECK.

VI.

THE ORBIT.

THE ORBIT.

Quadrilateral pyramidal fossa looking forwards & outwards and formed by seven bones, the frontal, ethmoid, sphenoid (which enter into formation of both orbits), superior maxillary, malar, lachrymal & palate.

Communicates with cranium, and with nasal, temporal, zygomatic & spheno-maxillary fossæ through optic foramen, nasal duct & spheno-maxillary fissure.

Presents:

ROOF — Formed by orbital plate of frontal & lesser wing of sphenoid. Is concave, and presents the suture between the foregoing bones, and in front the

Lachrymal fossa for lacrymal gland, and a

Depression (fovea trochlearis) for pulley of superior oblique.

FLOOR — Formed by upper or orbital surface of superior maxillary and orbital processes of malar & palate bones. Presents the sutures between foregoing bones, the

Infra-orbital groove for infra-orbital vessels & nerve, which becomes converted in front into

Infra-orbital canal; and also at its anterior & inner part a

Depression for inferior oblique muscle.

INNER WALL — Formed from before backwards by nasal process of superior maxillary, lachrymal, os planum of ethmoid, body of sphenoid. Is antero-posterior in direction and parallel to its fellow, and presents the sutures between foregoing bones and the

Lachrymal groove for lachrymal sac,

Crest of lachrymal bone for tensor tarsi muscle.

OUTER WALL — Formed in front by orbital process of malar bone, and behind by anterior or orbital surface of great wing of sphenoid. Is very oblique forwards & outwards being nearly at right angles with its fellow, and presents the suture between foregoing bones, and the

Orifices of one or two malar canals,

Small spine for lower head of external rectus.

ANGLES:

SUP. EXTERNAL – Presents:

Articulation of frontal with malar bone & orbital plate of sphenoid,

Sphenoidal fissure or *foramen lacerum anterius* for 3rd, 4th & 6th nerves and ophthalmic nerve & vein.

SUP. INTERNAL – Presents

Suture connecting frontal with lachrymal & os planum, in which suture are the

Anterior ethmoidal canal for nasal nerve & anterior ethmoidal vessels, and the

Posterior ethmoidal canal for posterior ethmoidal vessels.

INF. EXTERNAL – Presents

Spheno-maxillary fissure for infra-orbital vessels & nerve and ascending branches of Meckel's ganglion.

INF. INTERNAL – Presents

Articulation of superior maxillary & palate bones with lachrymal & os planum.

CIRCUMFERENCE OR BASE — Quadrilateral, looks forwards & outwards. Is bounded by supra-orbital arch and external & internal angular processes of frontal, anterior border of orbital surface & nasal process of superior maxillary, and anterior border of malar bone. Presents

Supra-orbital notch or foramen for supra-orbital vessels & nerve; and assists in forming

Lachrymal groove for lachrymal sac.

APEX — Corresponds to optic foramen for optic nerve & ophthalmic artery.

FOURTH NERVE, TROCHLEARIS or PATHETICUS.

Arises from upper part of *valve of Vieussens* immediately behind the testis. — Deep origin is from two grey nuclei situated on floor of aqueduct of Sylvius & on upper part of floor of 4th ventricle.
Crosses processus e cerebello ad testes and winds round under surface of crus cerebri immediately in front of pons Varolii
Pierces dura mater in free border of tentorium cerebelli near posterior clinoid process.
Through outer wall of cavernous sinus below 3rd nerve and above ophthalmic branch of the 5th, receiving filaments from ophthalmic branch & from carotid plexus:
Through highest and broadest part of sphenoidal fissure.
Inwards above levator palpebræ superioris to orbital surface of superior oblique.

FIFTH NERVE.

Arises by two roots, anterior small or motor, posterior large or sensory, from *side of pons Varolii nearer to upper than to lower border.* Its deep origin is said to be from lateral tract of medulla behind olivary body, from grey nucleus on floor of 4th ventricle between restiform body & fasciculi teretes, from tubercle of Rolando; its motor root appears to arise from pyramidal body.

Through opening in dura mater near apex of petrous portion of temporal bone. Sensory root to Gasserian ganglion; motor root to inferior maxillary nerve outside cranium.

Gasserian ganglion – Crescentic. Situated in a depression near apex of petrous portion of temporal bone, and receives filaments from carotid plex. Gives off anteriorly ophthalmic, superior & inferior maxillary nerves, and laterally, small branches to tentorium cerebelli & dura mater of middle fossa, and one to 6th nerve in cavernous sinus.

OPHTHALMIC NERVE — The smallest of the three divisions of the 5th pair.

Through outer wall of cavernous sinus below 3rd & 4th nerves, being joined by filaments from cavernous plexus and frequently from 4th nerve, and giving off recurrent branches to tentorium.

Divides near sphenoidal fissure into lachrymal, frontal, nasal.

LACHRYMAL N. — The smallest.

Through outer & narrowest part of sphenoidal fissure, and along upper border of external rectus to lachrymal gland, conjunctiva & skin of upper eyelid. — Joins with orbital branch of superior maxillary nerve.

FRONTAL N. — The largest.

Through highest & broadest part of sphenoidal fissure;

Along middle line of orbit between levator palpebræ superioris & periosteum, and divides into:

SUPRAORBITAL BR. — The largest. Through supraorbital foramen or notch, and ascends to corrugator supercilii, occipito-frontalis & orbicularis palpebrarum, and to periosteum & integument, the cutaneous branches, two in number, lying at first beneath the muscles.

SUPRATROCHLEAR BR. — The smallest. Above pulley of superior oblique, and same destribution. Joins with infratrochlear branch of nasal.

NASAL N.—Intermediate in size. Vide p. 207.

THIRD NERVE or MOTOR OCULI.

Arises from inner border of crus cerebri immediately in front of pons Varolii. — Deep origin is from locus niger, tubercula quadrigemina, valve of Vieussens & grey nucleus on floor of aqueduct of Sylvius.

Pierces dura mater on outer side of and a little behind, anterior clinoid process.

Through outer wall of cavernous sinus above 4th nerve & ophthalmic branch of 5th, being joined by filaments from cavernous plexus.

Divides into superior & inferior branches, which pass through sphenoidal fissure between the two heads of external rectus.

Superior Br. – The smallest. Inwards above optic nerve to *levator palpebræ superioris* & *superior rectus*.

Inferior Br. – The largest. To *internal & inferior recti and inferior oblique*. — Short or Motor root of Lenticular Ganglion is derived from nerve to inferior oblique.

MUSCLES.

ORIGINS.

Internal & Inferior Recti & Lower Head of External Rectus – Incomplete fibrous ring termed the ligament of Zinn, which surrounds optic foramen, except at its upper & outer part. – Lower head of external rectus also arises from a small spine on orbital surface of greater wing of sphenoid.

Superior Rectus & Upper Head of External Rectus – Upper margin & upper part of outer margin of optic foramen.

Levator Palpebræ Superioris – Under surface of lesser wing of sphenoid in front of optic foramen & externally to superior oblique.

Superior Oblique – Under surface of lesser wing of sphenoid in front of optic foramen & internally to levator palpebræ superioris.

Inferior Oblique – Depression on orbital plate of superior maxilla close to lachrymal groove.

INSERTIONS.

The Four Recti – Fore part of sclerotic about four lines from cornea.

Superior & Inferior Oblique – Upper & outer part of sclerotic between superior & external recti and midway between cornea & optic nerve.

Levator Palpebræ Superioris – Upper border of superior tarsal cartilage.

NERVE-SUPPLY — Levator palpebræ superioris & superior rectus, *upper division of 3rd nerve;* – internal & inferior recti and inferior oblique, *lower division of 3rd nerve:* – superior oblique, *4th nerve;* – external rectus, *6th nerve.*

NASAL NERVE.

Intermediate in size between the lachrymal & frontal.
Between the two heads of external rectus, and forwards & inwards across optic nerve.
Through anterior ethmoidal foramen, and through groove on cribriform plate & slit by crista galli to nose, where divides into

INTERNAL BR. — To mucous membrane of fore part of septum;

EXTERNAL BR. — In groove on inner surface of nasal bone, between that bone & lateral cartilage, and downwards to tip of nose beneath compressor nasi supplying mucous membrane & integument.

Gives off:

GANGLIONIC BR. — Long & slender; to posterior superior angle of ciliary ganglion, forming its long or sensory root.

LONG CILIARY NS. — Two or three; join ciliary nerves from ciliary ganglion. (Vide Ciliary Ganglion).

INFRATROCHLEAR BR. — Beneath pulley of superior oblique, where joins with supratrochlear branch of frontal, to orbicularis, lachrymal sac, caruncula, conjunctiva & skin of eyelids.

CILIARY, OPHTHALMIC or LENTICULAR GANGLION.

Reddish grey quadrangular body of the size of a pin's head situated at back of orbit on outer side of optic nerve. — Presents:

THREE ROOTS:

Sensory, or Long & Slender Root — From *nasal branch of ophthalmic* to posterior superior angle of ganglion; is accompanied by the sympathetic root, which is sometimes blended with it.

Motor, or Short & Thick Root — From *branch of 3rd nerve to inferior oblique* to posterior inferior angle; is occasionally divided into two parts.

Sympathetic Root — Long & slender filament from *cavernous plexus;* accompanies sensory root, with which it is sometimes blended.

BRS. OF DISTRIBUTION:

Ciliary Ns. — Ten or twelve from anterior angles of ganglion, forming a small superior & a large inferior bundle;

Forwards above & below optic nerve with ciliary branches of nasal;

Through back part of sclerotic, and in grooves on its inner surface to ciliary muscle, cornea & iris.

OPHTHALMIC ARTERY.

Arises from internal carotid as that vessel emerges from cavernous sinus between optic nerve & anterior clinoid process.

Through optic foramen below & on outer side of optic nerve.

Over optic nerve, and forwards beneath superior oblique to superior internal angle of orbit, where divides into frontal & nasal.

BRANCHES — May be divided into:

ORBITAL GROUP:

Lachrymal – With lachrymal nerve & above external rectus to lachrymal gland & upper eyelid. Gives off small malar & temporal branches, which perforate malar bone to temporal fossa & cheek.

Supraorbital – With frontal nerve & above the muscles to supraorbital foramen, where divides into superficial & deep branches to integument & muscles of forehead & pericranium.

Ethmoidal – Anterior & posterior. Through anterior & posterior ethmoidal foramina (former with nasal nerve), giving branches to ethmoidal cells & dura mater, and then through foramina in cribriform plate of ethmoid to septum & outer wall of nose.

Palpebral – Superior & inferior. Encircle eyelids near free margin & beneath orbicularis, and anastomose with infraorbital & with orbital branch of temporal.

Frontal – From orbit at its superior internal angle to skin & muscles of forehead & pericranium, joining with supraorbital.

Nasal – Above tendo oculi, and divides into dorsalis nasi to dorsum of nose and anastomotic branch to angular branch of facial.

OCULAR GROUP:

Muscular – Very variable, usually divided into:

SUPERIOR – Smaller, to levator palpebræ superioris, superior rectus & superior oblique;

INFERIOR – Larger, to inferior oblique & the other recti, and gives off most of the anterior ciliary arteries.

Ciliary – May be divided into:

SHORT POSTERIOR – Surround optic nerve, and through sclerotic a line or two from the nerve to ciliary processes & choroid.

LONG – Two. Through back part of sclerotic, and between sclerotic & choroid on either side of eyeball to ciliary body, where bifurcate and form great arterial circle of iris, from which small twigs converge to free margin of iris forming lesser arterial circle.

ANTERIOR – Chiefly from muscular. Through sclerotic a line or two from margin of cornea to great arterial circle of iris.

Centralis Retinæ – Pierces optic nerve, and forwards in its substance to retina. In fœtus a small branch passes forwards through vitreous body to posterior part of capsule of lens.

SECOND or OPTIC NERVE.

Presents for examination the optic tract, the optic commissure & the optic nerve proper.

OPTIC TRACT

Begins in the *anterior & posterior quadrigeminal bodies* by two distinct bundles of fibres, which pass between the *corpora geniculata internum et externum*, become respectively connected with and receive fibres from the latter, unite, and receive additional fibres from the *optic thalamus*.

Winds obliquely forwards across under surface of crus cerebri, being flattened in shape and slightly attached to the crus by its anterior margin.

Leaves the crus as a round bundle and becomes connected with the *lamina cinerea & the tuber cinereum*, from both of which it is said to receive additional fibres.

Joins its fellow to form optic commissure.

OPTIC COMMISSURE or CHIASMA

Is formed as follows:

A few of the outer fibres of each optic tract pass into the optic nerve of the same side.

The mass of the fibres decussate, and pass into the optic nerve of the opposite side.

A few of the innermost fibres, termed the inter-cerebral fibres, pass back to the cerebrum, forming the posterior fibres of the commissure and the innermost fibres of the optic tract of the opposite side.

A few similar fibres, termed the inter-retinal fibres, pass along the anterior border of the commissure from one optic nerve to the other.

OPTIC NERVE

Through optic foramen, being surrounded by a tubular process of the dura mater, which, as the nerve enters the orbit, subdivides, and both continues the sheath of the optic nerve, and forms the periosteum of the orbit.

Pierces sclerotic and choroid about one tenth of an inch to the inner side of the axis of the eye, and expands into the retina. – The arteria centralis retinæ pierces the optic nerve, and runs forwards in its substance to the retina.

SIXTH NERVE or ABDUCENS.

Arises by several filaments from *constricted part of corpus pyramidale* close to pons Varolii or from *lower border of pons itself.* — Deep origin is from a grey nucleus on floor of 4th ventricle.

Pierces dura mater on basilar groove immediately below posterior clinoid process.

Forwards on floor of cavernous sinus on outer side of internal carotid artery, receiving filaments from carotid plexus, Meckel's ganglion & ophthalmic nerve.

Through sphenoidal fissure beneath the other nerves & above ophthalmic vein, receiving filaments from sympathetic.

Between the two heads of external rectus to ocular surface of that muscle.

RELATIONS of the NERVES of the ORBIT.

CAVERNOUS SINUS:

Third & Fourth Ns. & Ophthalmic br. of Fifth — Pass through outer wall of cavernous sinus in their numerical order both from above downwards and from within outwards.

Sixth N. — Lies on floor of cavernous sinus on outer side of internal carotid artery, on inner side of ophthalmic nerve.

SPHENOIDAL FISSURE:

Fourth N., Frontal & Lachrymal Divisions of Ophthalmic N. — Enter orbit above external rectus.

The other Ns. — Pass between the two heads of external rectus in following order from above downwards: *Superior division of 3rd N., Nasal branch of Ophthalmic, Lower division of 3rd N., Sixth Nerve.*

ORBIT:

Fourth N., Frontal & Lachrymal Divisions of Ophthalmic N. — Lie above the muscles immediately beneath periosteum.

The other Ns. — Are found in the following order from above downwards: *Superior division of 3rd N., Nasal branch of Ophthalmic* crossing optic N., *Optic N.*, having lenticular ganglion on its outer side, *Inferior division of the 3rd N., Sixth Nerve.*

HEAD & NECK.

VII.

PHARYNX & SOFT PALATE.

BACK OF NECK.

THE PHARYNX.

Is a musculo-membranous bag extending from base of skull to lower border of cricoid cartilage in front & 5th cervical vertebra behind; about 4½ inches long; broadest from side to side, its greatest breadth being comprised between cornua of hyoid bone.

It is bounded above by petrous portion of temporal bone and by under surface of body of sphenoid; – not, as has hitherto been stated, by basilar process of occipital, the recti capitis antici muscles passing forwards between roof of pharynx & whole length of that process (Thomson & Cleland).

It is continuous below with œsophagus.

It is connected behind by loose areolar tissue to the cervical vertebræ & the longi colli & recti capitis antici muscles.

In front it is attached from above downwards to:

Internal pterygoid plate;
Pterygo-maxillary ligament;
Lower jaw;
Base of tongue;
Cornua of hyoid bone & stylo-hyoid ligament;
Thyroid & cricoid cartilages.

Laterally it is in relation with styloid process, styloid & pterygoid muscles, internal carotid artery, internal jugular vein, glosso-pharyngeal, pneumogastric, spinal accessory, hypoglossal & sympathetic nerves; and also, below, with lateral lobes of thyroid gland, common carotid artery & sterno-hyoid, and, in front, with hyo-glossus muscle and lingual artery & nerve.

It presents seven openings: – nares, Eustachian tubes, mouth, larynx, œsophagus.

STRUCTURE of the PHARYNX.

Presents three coats, which, from without inwards, are muscular, fibrous, mucous; and vessels & nerves.

MUSCULAR COAT — Is formed by:

Inferior Constrictor – Side of cricoid cartilage; oblique line on outer surface of ala of thyroid cartilage & surface behind it, and inferior cornu.

Raphé on posterior median line of pharynx; its inferior fibres being horizontal & continuous with those of œsophagus, and its superior fibres passing obliquely upwards and overlapping those of the middle constrictor. – S. by pharyngeal plexus and external & recurrent laryngeal nerves.

Middle Constrictor – Whole extent of upper surface of great cornu of hyoid bone, lesser cornu, stylo-hyoid ligament.

Raphé on posterior median line of pharynx; its inferior fibres descending beneath inferior constrictor, its middle fibres being horizontal, and its superior fibres overlapping superior constrictor & stylo-pharyngens. – S. by pharyngeal plexus.

Superior Constrictor – Lower third of free margin of internal pterygoid plate, its hamular process, & contiguous part of palate bone; pterygo-maxillary ligament; alveolar process of inferior maxilla above mylo-hyoid ridge; side of tongue.

Raphé on posterior median line of pharynx; its superior fibres ascending by means of strong fibrous band below mentioned, to pharyngeal spine on basilar process, its lower fibres being horizontal. – S. by pharyngeal plexus.

Stylo-pharyngeus – Inner side of base of styloid process.

With palato-pharyngeus into posterior border of thyroid cartilage & side of pharynx. – S. by pharyngeal plexus & glosso-pharyngeal nerve.

Palato-pharyngeus – Posterior surface of soft palate by two heads separated by levator palati.

With stylo-pharyngeus into posterior border of thyroid cartilage & side of pharynx. – S. by pharyngeal plexus.

Salpingo-pharyngeus (Santorini) – Small fasciculus from outer surface of cartilaginous portion of Eustachian tube to stylo-pharyngeus, with which it blends inferiorly. Is often wanting.

Other accessory muscles, the petro-, spheno-, & occipito-pharyngei, are also described; but they are rarely met with.

Relations – The constrictors overlap each other from below upwards. The stylo-pharyngeus passes between superior & middle constrictors; the superior laryngeal nerve between the middle & inferior constrictors; the recurrent laryngeal nerve beneath the inferior. – (Vide also relations of pharynx in foregoing Tablet).

FIBROUS COAT, or PHARYNGEAL APONEUROSIS — Thick above, thin below. Attached to petrous portion of temporal bone, under surface of body of sphenoid, and, by means of a strong fibrous band (cranio-pharyngeal ligament, Thomson & Cleland), to pharyngeal spine on under surface of basilar process.

MUCOUS MEMBRANE — Thick on under surface of body of sphenoid; covered with columnar ciliated epithelium as low down as floor of nares, with squamous epithelium below. Beneath it are found numerous glands, which are simple & compound follicular and racemose.

VESSELS & NERVES — Arteries. Ascending pharyngeal, pterygo-palatine, superior or descending palatine, superior thyroid. – Veins. Open into the superior thyroid & internal jugular. – Lymphatics. Open into deep glands of neck. – Nerves. From pharyngeal plexus, and from external & recurrent laryngeal nerves.

THE SOFT PALATE.

Musculo-membranous fold, which forms an incomplete septum between the mouth and pharynx. Presents:

Anterior Surface – Concave; presents a median raphé, continuous with that of hard palate.

Posterior Surface – Convex, continuous with floor of nasal fossæ; presents the median projection of the azygos uvulæ.

Upper Border – Attached to posterior border of hard palate.

Lower Border – Free; presents the uvula and the anterior & posterior pillars, which two latter embrace the tonsil.

ANTERIOR PILLARS – Downwards & forwards to sides of base of tongue; contain palato-glossi muscles.

POSTERIOR PILLARS – Downwards & backwards to sides of pharynx; contain palato-pharyngei muscles Are rather broader and approach nearer to each other than the anterior.

ISTHMUS FAUCIUM – Is the space bounded by the free border & pillars of the soft palate, the tonsils, and the base of the tongue.

STRUCTURE of the SOFT PALATE

Presents for examination:

APONEUROSIS — Blended with tendon of tensor palati. Is thickest above, where it is attached to posterior border of hard palate.

MUSCLES — Five on each side:

Levator Palati – Under surface of apex of petrous portion of temporal bone and outer aspect of cartilaginous portion of Eustachian tube.
Posterior surface of soft palate between the two heads of origin of palato-pharyngeus. – S. by post. or small palatine branch from Meckell's g.

Tensor or Circumflexus Palati – Scaphoid fossa at base of internal pterygoid plate; spine of sphenoid; anterior aspect of cartilaginous portion of Eustachian tube.
Winds round hamular process and expands upon anterior surface of aponeurosis of soft palate. – S. by a branch from otic ganglion.

Palato-glossus – Anterior surface of soft palate.
Posterior part of side of tongue, where it blends with stylo-glossus.

Palato-pharyngeus – Posterior surface of soft palate by two heads separated by the levator palati.
Posterior border of thyroid cartilage & sides of pharynx.

Azygos Uvulæ – Posterior nasal spine of palate bone & aponeurosis of soft palate.
Uvula. – S. by posterior or small palatine branch from Meckell's gangl.

MUCOUS MEMBRANE — Thin; covered with squamous epithelium, except near Eustachian tube, where the epithelium is columnar & ciliated. Numerous mucous glands are found beneath it, especially over posterior surface & uvula, in which latter situations they form a continuous layer.

VESSELS & NERVES — ARTERIES. Inferior or ascending palatine, posterior or descending palatine, ascending pharyngeal, dorsalis linguæ, tonsillar. – VEINS. Join the tonsillar & pterygoid plexuses. – LYMPHATICS. To glands beneath angle of jaw. – NERVES. From fifth, facial & glosso-pharyngeal.

SHORT POSTERIOR CRANIO-VERTEBRAL MUSCLES.

Rectus Capitis Posticus Major – Spinous process of axis.
Into and beneath outer part of inferior curved line of occipital bone.

Rectus Capitis Posticus Minor – Tubercle on posterior arch of atlas.
Into and beneath inner part of inferior curved line of occipital bone.

Obliquus Capitis Inferior – Spinous process of axis.
Extremity of transverse process of atlas.

Oblquus Capitis Superior – Extremity of transverse process of atlas.
Occipital bone between the two curved lines externally to the complexus & rectus capitis posticus major.

These muscles are supplied by the posterior branch of the suboccipital nerve; the inferior oblique is also supplied by the great occipital nerve.

THE VERTEBRAL ARTERY

Arises from upper & back part of first portion of subclavian.
Upwards & backwards to foramen in transverse process of 6th cervical vertebra, passing behind vasculo-nervous bundle of the neck and more particularly behind inferior thyroid artery & internal jugular vein, and then between scalenus anticus & longus colli.
Upwards through the series of foramina in the transverse processes as far as upper border of axis with the vertebral vein and a plexus of the sympathetic, the artery lying between the vein which is in front, and the cervical nerves which emerge behind from the intervertebral foramina.
Upwards & outwards to, and then through, foramen in transverse process of atlas.
Backwards & inwards behind lateral mass in groove on posterior arch of atlas, lying in the triangular space between the recti & obliqui muscles, and being crossed by the posterior branch of the suboccipital nerve and covered by the complexus
Pierces posterior occipito-atloid ligament, and enters the skull through the foramen magnum.
Winds round medulla oblongata between hypoglossal nerve and anterior root of suboccipital; ascends obliquely between anterior surface of medulla oblongata & basilar process, and joins its fellow opposite lower border of pons Varolii to form basilar trunk.

BRANCHES — Are cervical & cranial.

CERVICAL:

Muscular – Several, small, to the deep muscles of the neck.
Lateral Spinal – Through intervertebral foramina, and divide into:
Ant. Branch – To posterior surface of bodies of vertebræ;
Post. Branch – To roots of nerves, cord & its membranes.

CRANIAL:

Posterior Meningeal – Two or three, small, to dura mater of cerebellar fossa.
Posterior & Anterior Spinal – Arise respectively behind upper part of cord and in front of medulla.
The two posterior descend behind the roots of the spinal nerves;
The two anterior unite into a single trunk, which descends along middle line of cord.
Both join with, and are reinforced by, the numerous spinal branches derived from the vertebral, ascending cervical, inferior thyroid, the intercostal, lumbar, ilio-lumbar and lateral sacral; and are thus each of them continued as small tortuous vessels, or rather as a series of inosculating vessels, down to the extremity of the cord, where they resolve into twigs to cauda equina.
Posterior Inferior Cerebellar – Backwards round medulla between pneumogastric & spinal accessory nerves, and over restiform body to median fissure or valley on under surface of cerebellum. Gives off an offset to under surface of cerebral hemisphere and twigs to choroid plexus of 4th ventricle.

THE TWO FIRST SPINAL NERVES.

POSTERIOR DIVISION OF

First Cervical Nerve (Suboccipital) – Larger than anterior. Emerges between occipital bone & posterior arch of atlas just behind vertebral artery, enters triangle formed by small posterior cranio-vertebral muscles, supplies these muscles & complexus, and joins with posterior division of 2nd cervical nerve. Sometimes gives off a small cutaneous branch, which branch, when it exists, accompanies occipital artery to integument of lower & back part of occiput, and joins with great & small occipital.

Second Cervical Nerve – Three or four times as large as anterior division, and the largest of the posterior cervical nerves. Emerges between posterior arch of atlas & lamina of axis, supplies inferior oblique, and after joining with posterior division of 1st & 3rd cervical nerves, divides into:

External Branch – Similar to external branches of six lower posterior cervical nerves, but somewhat larger, joins with corresponding branch of 3rd posterior cervical nerve, and supplies the same muscles, & also the complexus.

Internal Branch (Great Occipital Nerve) – Crosses triangle formed by posterior cranio-vertebral muscles, pierces complexus & trapezius, joins with small occipital & with ascending twig from internal branch of posterior division of 3rd, and supplies integument of back of head as far as vertex; gives off an auricular branch to back of ear.

ANTERIOR DIVISION OF

First Cervical Nerve (Suboccipital) – Small. Emerges between occipital bone & posterior arch of atlas below vertebral artery. Passes forwards on inner side of vertebral artery & rectus lateralis muscle, crosses foramen in transverse process of atlas, and descends in front of this process to join with ascending branch of the second. Supplies the rectus lateralis & the recti capitis antici major & minor, and communicates with the pneumogastric, hypoglossal, & superior cervical ganglion of sympathetic.

Second Cervical Nerve – Larger than foregoing, but still much smaller than the posterior division of the same nerve. Emerges between posterior arch of atlas & lamina of axis, passes forwards between transverse processes of the same vertebræ on outer side of vertebral artery, and divides into an ascending branch, which joins the first nerve, and a descending branch, which joins the second. Gives off the small occipital nerve.

ARTICULATIONS of the CRANIUM with the SPINE

Are the *occipito-atloid* and *occipito-axoid* articulations, from which articulations the *atlo-axoid* articulation cannot well be separated.

OCCIPITO-ATLOID ARTICULATION — Consists of a double arthrodia between condyles of occipital and superior articular surfaces of atlas; the condyles being convex from before backwards & inwards and looking downwards & outwards, and the articular surfaces of the atlas being concave from before backwards & inwards and looking upwards & inwards. The ligaments are: –

Capsular – Two. Thin & loose; surround the arthrodial articulations. The synovial membranes of these articulations often communicate with that of the syndesmo-odontoid articulation.

Ant. Occipito-Atloid – Two:

SUPERFICIAL – Strong rounded cord from *Basilar process* to – *Anterior tubercle of atlas.*

DEEP – Thin & broad membrane from *Anterior margin of foramen magnum* to – *Upper border of anterior arch of atlas.*

Post. Occipito-Atloid – Thin & broad membrane from *Posterior margin of foramen magnum* to – *Upper border of posterior arch of atlas.* It is perforated on either side by vertebral artery & suboccipital n.

Lateral Occipito-Atloid – Two. Strong bands from *Jugular process* to – *Base of transverse process of atlas.*

OCCIPITO-AXOID ARTICULATION — No direct contact between the two bones, but the two bones are firmly connected together, nevertheless, by the following ligts: –

Occipito-Axoid – Strong broad band expanded superiorly, and which may be considered as a continuation upwards of the posterior common ligament of the bodies of the vertebræ; from *Basilar groove of occipital*, where it becomes continuous with dura mater of skull, to – *Posterior surface of body of axis.* – It covers and conceals the cruciform ligament.

Occipito-Odontoid – Three, two lateral & one median.

LATERAL OCCIPITO-ODONTOID OR CHECK LIGAMENTS – Strong rounded cords from *Rough depression on inner side of condyles of occipital* to – *Sides of odontoid pr. near its apex.*

MEDIAN OR SUSPENSORY OCCIPITO-ODONTOID LIGAMENT – Strong band from *Anterior margin of foramen magnum* to – *Apex of odontoid process.* – This band is situated between, & blended superiorly, with deep anterior occipito-atloid ligt., on the one hand, & upper fasciculus of cruciform ligt. on the other.

VERTICAL FASCICULUS OF CRUCIFORM LIGT. – V. below.

ATLO-AXOID ARTICULATION — Is a complex articulation consisting: 1. of a double arthrodia between the articular processes, the articular surfaces of which are large, flat, circular, and inclined downwards & outwards. 2. of a double diarthrosis rotatorius between the anterior & posterior surfaces of the odontoid process, on the one hand, and the posterior & anterior surfaces respectively of the anterior arch of the atlas & of the transverse ligament, on the other hand, (atlo-odontoid & syndesmo-odontoid articulations, Cruveilhier). The ligaments are: –

Capsular – Two. Thin, loose, strongest externally; surround the two arthrodiæ.

Ant. Atlo-Axoid – Two:

SUPERFICIAL – Strong rounded cord from *Anterior tubercle of atlas* to – *Base of odontoid proccess & front of body of axis.*

DEEP – Thin & broad membrane from *Lower border of anterior arch of atlas* to – *Base of odontoid process & front of body of axis.*

Post. Atlo-Axoid – Thin & broad membrane from *Lower border of posterior arch of atlas* to – *Upper border of laminæ of axis.*

Transverse – Strong transverse band, broadest in middle, which divides ring of atlas into a small anterior part, in which anterior part the neck of the odontoid process is firmly constricted, and a much larger posterior part, which transmits the cord & its membranes & the spinal accessory nerves. It is attached on each side to a *Tubercle on inner surface of lateral mass of atlas* – Its anterior surface is lined with synovial membrane of syndesmo-odontoid articulation. From its upper & lower borders, or rather from its posterior surface, are given off two fasciculi, which pass upwards & downwards to be attached, the one to the *basilar groove*, the other to *posterior surface of body of axis*; with the transverse band, these vertical fasciculi form the *cruciform ligament.* The synovial membrane of the syndesmo-odontoid articulation often communicates with one or both of those of the occipito-atloid arthrodiæ.

HEAD & NECK.

VIII.

NASAL FOSSÆ, AND DEEP VESSELS & NERVES OF NECK.

THE NASAL FOSSÆ.

Two narrow irregular cavities comprised between the orbits & superior maxillary bones, and between the roof of the mouth & the front part of the base of the skull. Formed by ethmoid, sphenoid, frontal, superior maxillary, nasal, palate, inferior turbinated & vomer (all the bones of the face except malar & inferior maxillary). Communicate with orbit (nasal duct), mouth, (anterior palatine canal), cranium (olfactory foramina), spheno-maxillary fossa (spheno-palatine foramen), and with the frontal, ethmoidal, sphenoidal, & maxillary sinuses. – Present:

ROOF — Narrow, and is from before backwards:
Oblique upwards & backwards and formed by nasal bone & nasal spine of frontal,
Horizontal and formed by cribriform plate of ethmoid,
Oblique downwards & backwards and formed by body of sphenoid. – Presents the sutures between the foregoing bones and from before backwards:
Groove on nasal bone for outer branch of nasal nerve;
Half crest for perpendicular plate of ethmoid;
Olfactory foramina & nasal slit for olfactory and nasal nerves;
Openings of sphenoidal sinuses partly closed by sphenoidal turbinated bones;
Articulation of alæ of vomer with body of sphenoid.

FLOOR — Concave from side to side, and formed by palate processes of superior maxillary & palate bones. – Presents the suture between foregoing bones & the
Upper orifice of the anterior palatine canal;
Half crest for vomer, which terminates in front & behind in the
Anterior & posterior nasal spines.

INNER WALL — Formed principally by the perpendicular plate of the ethmoid above & in front, and by the vomer below & behind, and secondarily by nasal spine of the frontal, rostrum of sphenoid, crests of superior maxillary, nasal & palate bones. Has an angular deficiency in front which is filled up by the cartilage of the septum. – Is frequently inclined to one or other side; and presents the sutures between the foregoing bones and
Vascular & nervous furrows &
Naso-palatine groove for naso-palatine nerve.

OUTER WALL — Formed by:
Lacrymal bone & nasal process of superior maxillary;
Inner surface of ethmoid, superior maxillary & inferior turbinated bones;
Vertical plate of palate bone & inner plate of pterygoid process. – Presents the sutures between the foregoing bones and from above downwards:
Superior turbinated process of ethmoid;
Superior meatus, into which open the sphenoidal & posterior ethmoidal sinuses and the spheno-palatine foramen. – Both are short and are situated at the posterior and upper part of the nares;
Middle turbinated process of ethmoid;
Middle meatus, larger than foregoing, into which open the Antrum of Highmore and through the infundibulum, the anterior ethmoidal cells & frontal sinuses;
Inferior turbinated bone;
Inferior meatus, the largest, presents in front the opening of the nasal duct.

FIRST or OLFACTORY NERVE

Arises by three roots.

THE THREE ROOTS — Are the:

External or Long Root — Arises from the *posterior border of the fissure of Sylvius*, and is said to be traceable to the corpus striatum, the anterior commissure, the thalamus opticus & the Island of Reil.

It passes forwards and inwards along the anterior margin of the locus perforatus anticus.

Internal or Short Root — Arises from the *posterior and inner part of the anterior lobe*, and is said by Foville to be connected with the longitudinal fibres of the gyrus fornicatus or convolution of the corpus callosum.

It passes forwards & outwards, and joins the foregoing root just above the origin of the middle or grey root.

Middle or Grey Root — Begins in a pyramidal eminence, the *caruncula mammillaris*, of the grey matter of the posterior part of the anterior lobe, and is continued upon the upper surface of the nerve with a few white fibres derived from the corpus striatum.

The three roots coalesce and form a prismoid band, the

OLFACTORY PROCESS, — which passes forwards in a deep sulcus along the side of longitudinal fissure, and expands into the

OLFACTORY BULB, — from the under surface of which are given off about twenty

TERMINAL BRS., — which pass through the foramina in the cribriform plate of the ethmoid, and — forming *three sets* distributed respectively over the *roof of the nose*, over the *upper third of the septum*, and over the *superior & middle turbinated bones* — proceed between the fibrous & mucous layers of the Schneiderian membrane, ramify and unite and form a plexus with narrow elongated meshes, and probably terminate in the deep processes of the olfactory cells of Schultze.

These latter cells are spindle-shaped nucleated bodies, which stand vertically in great numbers among the columnar epithelial cells of the olfactory region; their extremities are continued into two thread-like processes, one of which terminates abruptly on a level with the free extremities of the epithelial cells, while the other passes downwards towards the attached surface of the mucous membrane.

The olfactory nerve contains a *large proportion of the grey matter*, and is soft and pulpy. Its filaments are deficient in the white substance of Schwann, and are granular and nucleated like the gelatinous nerve-fibres of Remak.

SUPERIOR MAXILLARY NERVE.

Intermediate in size between ophthalmic & inferior maxillary nerves. – Commences at middle of Gasserian ganglion

Through foramen rotundum, spheno-maxillary fossa & infraorbital canal to infraorbital foramen, and divides beneath levator labii superioris into *palpebral, nasal & labial branches*, which branches anastomose with facial nerve forming infraorbital plexus and supply muscles, skin & mucous membrane.

BRANCHES:

Orbital or Temporo-malar Br. – Into orbit through spheno-maxillary fissure, and divides into:

Temporal Br. – In groove & through foramen in malar bone, joining with lachrymal;

Pierces temporal muscle & fascia to skin of temple, and joins with facial & auriculo-temporal.

Malar Br. – Through foramen in malar bone to skin of prominent part of cheek.

Spheno-palatine Brs. – Two. To Meckel's ganglion, of which they form the sensory root.

Post. Dental Brs. – Two:

Anterior or Superficial – Over maxillary tuberosity to gums & buccinator.

Posterior or Deep – Forwards in outer wall of Antrum, joining anterior dental nerve, and supplies molar & second bicuspid teeth & mucous membrane of Antrum.

Ant. Dental Br. – Arises just before exit of superior maxillary nerve from infra-orbital canal.

Downwards & forwards in anterior wall of Antrum joining with posterior dental nerve, and supplies incisor, canine & first bicuspid teeth and mucous membrane of inferior meatus. A twig joins superior nasal branch of Meckel's ganglion above eye-tooth, and presents a small ganglion, the ganglion of Bochdalek.

SPHENO-PALATINE or MECKEL'S GANGLION.

Triangular, of a reddish grey colour and situated in spheno-maxillary fossa near spheno-palatine foramen, mainly behind spheno-palatine branches of superior maxillary nerve, the fibres of these branches not being, or being but partly, involved in the ganglion as they descend to the nose & palate. Presents:

THREE ROOTS:

Sensory Root — From superior maxillary nerve through its two spheno-palatine branches.

Motor Root — From facial nerve through Vidian nerve.

Sympathetic Root — From carotid plexus also through Vidian nerve.

BRS. OF DISTRIBUTION — Are divided into:

Ascending Brs. — Two or three small filaments, which pass up through spheno-maxillary fissure to periosteum of orbit.

Descending Brs. — Are the:

ANT. OR GREAT PALATINE N. – Through great posterior palatine canal, giving off inferior nasal branches to middle meatus & to middle & inferior turbinated bones, and a twig to soft palate; Forwards in groove on hard palate, and joins termination of naso-palatine nerve.

EXT. PALATINE N. – Through external palatine canal to tonsil & soft palate. Is sometimes wanting.

POST. OR SMALL PALATINE N. – Through small posterior palatine canal to tonsil, soft palate and levator palati & azygos uvulæ.

Internal Brs. — Are the:

SUP. NASAL BR. – Small. Through spheno-palatine foramen to mucous membrane of superior & middle spongy bones & upper & back part of septum. A twig joins anterior dental nerve in outer wall of antrum of Highmore above eye-tooth & presents a small ganglion, the ganglion of Bochdalek.

NASO-PALATINE BR. – Through spheno-palatine foramen & across roof of nose to septum, and downwards to anterior palatine foramen. Through central division of the anterior palatine foramen, or foramen of Scarpa, right nerve being posterior to left one. Joins its fellow in common anterior palatine canal and ends in mucous membrane of hard palate, joining with anterior or great palatine nerve.

Posterior Brs. — Are the:

VIDIAN N. – Backwards through Vidian canal (if the nerve be traced from Meckel's ganglion), giving twigs to back of roof & septum of nose and to termination of Eustachian tube, and divides into:

LARGE PETROSAL N. – Through cartilaginous substance of foramen lacerum medium, and then in groove on anterior surface of petrous portion of temporal bone beneath Gasserian ganglion & through hiatus Fallopii to geniculate ganglion or intumescentia gangliformis of facial.

CAROTID BR. – Soft and of reddish grey colour. Through cartilaginous substance to carotid plexus on outer side of internal carotid artery.

PHARYNGEAL OR PTERYGO-PALATINE N. – Small. Through pterygo-palatine canal to mucous membrane of upper part of pharynx.

INFERIOR MAXILLARY NERVE.

The largest of the three divisions. Both sensory & motor, its two roots uniting immediately after their exit from foramen ovale.

Divides a few lines below base of skull into:

ANTERIOR or SMALLER DIVISION — Principally motor. Divides into:

Masseteric Br. – Outwards above external pterygoid muscle and through sigmoid notch to masseter. Gives off a twig to temporo-maxillary articulation & sometimes one to temporal muscle.

Deep Temporal Brs. – Two, anterior & posterior. Outwards above external pterygoid muscle and reflected upwards at pterygoid ridge to temporal muscle. Are sometimes joined, anterior one with buccal nerve, posterior one with masseteric.

Buccal Br. – Pierces external pterygoid, and forwards on buccinator, giving filaments to temporal muscle, integument & mucous membrane.

Pterygoid Brs. – Two, to internal & external pterygoid muscles. Branch to internal pterygoid gives off motor root to otic ganglion. Branch to external pterygoid is frequently derived from buccal.

POSTERIOR or LARGER DIVISION — Sensory with a few motor fibres. Divides into:

Auriculo-temporal N. – Has generally two roots which embrace middle meningeal artery. Backwards beneath external pterygoid & neck of condyle; Upwards with temporal artery between condyle & external ear under cover of parotid gland, and divides into:

Auricular Brs. – Inferior & superior, to outer surface of pinna, joining with great auricular.

Temporal Brs. – Anterior & posterior; with branches of temporal artery to skin of temporal region & vertex.

Joins facial nerve behind neck of condyle usually by two branches; gives off sensory root of otic ganglion and filaments to parotid gland & temporo-maxillary articulation.

Gustatory or Lingual N. – Between the two pterygoid muscles, where it lies on inner side & in front of inferior dental nerve, and is joined by chorda tympani; Above deep portion of submaxillary gland & along side of tongue, crossing Wharton's duct.

Supplies mucous membrane of mouth & gums, submucous glands, conical & fungiform papillæ and mucous membrane of tongue.

Gives sensory branches to submaxillary ganglion, and anastomoses with hypoglossal nerve on anterior margin of hyo-glossus & near tip of tongue.

Inf. Dental N. – Between the two pterygoid muscles, where lies behind & on outer side of gustatory;

Between ramus & internal lateral ligament of temporo-maxillary articulation to dental foramen, where gives off nerve to mylo-hyoid muscle.

Along inferior dental canal, giving branches to molar & bicuspid teeth, & divides at mental foramen into:

Incisor Br. – Onwards in dental canal to canine & incisor teeth.

Mental Br. – Divides beneath depressor anguli oris into numerous branches to muscles, skin & mucous membrane of lower lip.

NERVE to MYLO-HYOID – Along groove on inner surface of ramus to under surface of mylo-hyoid & anterior belly of digastric

N. — All the terminal branches of the 5th nerve upon the face. join with facial nerve.

OTIC GANGLION.

Small oval shaped flattened body of a reddish grey colour situated on inner surface of inferior maxillary nerve & around origin of its internal pterygoid branch, just below foramen ovale, close to tensor tympani muscle & cartilaginous portion of Eustachian tube which lie on its inner side, and to middle meningeal artery which lies behind. It presents:

THREE ROOTS:

Sensory Root – From auriculo-temporal nerve, and also from glosso-pharyngeal through small petrosal nerve.

Motor Root – From inferior maxillary nerve & its internal pterygoid branch; also from facial nerve through small petrosal.

Sympathetic Root – From plexus on middle meningeal artery.

BRS. OF DISTRIBUTION — Small branches to tensor palati & tensor tympani.

INTERNAL CAROTID ARTERY.

Commences at bifurcation of common carotid opposite upper border of thyroid cartilage & in the so-called superior carotid triangle. It is at first very superficial, being covered only by thin anterior border of sterno-mastoid, platysma & fascia, and lying on outer side of, & rather behind, external carotid artery.

May be divided into cervical, petrous, cavernous & cerebral portions.

CERVICAL PORTION — Ascends vertically to carotid foramen, passing (as does also external carotid)

BENEATH – Digastric & stylo-hyoid muscles, occipital artery, hypoglossal nerve, & parotid gland, – then ascending beneath, and being separated from external carotid by,

Stylo-glossus & -pharyngeus & the styloid process, the glosso-pharyngeal nerve and sometimes the pharyngeal branch of the vagus.–

Its deep relations are:

ON INNER SIDE – Pharynx, tonsil, ascending pharyngeal art., superior laryngeal n.

BEHIND – Rectus capitis anticus major & transverse processes of the three upper cervical vertebræ; – superior cervical ganglion & main trunk of sympathetic, and superior laryngeal nerves.

BEHIND & EXTERNALLY – Internal jugular vein, and, lying between & behind the two vessels, the pneumogastric nerve.

Usually gives off no branches.

PETROUS PORTION — Ascends in carotid canal in front of tympanum, being surrounded by carotid & cavernous plexuses, and then curves forwards & inwards. – Sends a small

Tympanic Branch – To tympanum through a minute foramen in posterior wall of carotid canal.

CAVERNOUS PORTION — Ascends to sphenoid bone, and then runs forwards in cavernous groove, lying in inner wall of cavernous sinus, by lining membrane of which it is covered, and being, on its outer side, crossed by 6th nerve and more distantly related to 3rd, 4th, & ophthalmic branch of the 5th.

Gives off:

Ophthalmic Artery – Vide p. 209.

Arteriæ Receptaculi – Several, small, to walls of cavernous sinus & dura mater.

CEREBRAL PORTION — Ascends between optic nerve & anterior clinoid process, perforates dura mater of roof of sinus, receives sheath from arachnoid, and after giving off

Post. Communicating & Ant. Choroid, divides opposite inner extremity of fissure of Sylvius into

Ant. & Middle Cerebral – Vide next Tablet.

Ant. Choroid Artery – Arises from internal carotid, or sometimes from middle cerebral.

Backwards through lateral part of transverse fissure of brain to descending cornu of lateral ventricle, and supplies choroid plexus.

THORAX.

I.

INNOMINATE VS. & SUP. VENA CAVA.

INNOMINATE VEINS — Two large trunks formed by junction of internal jugular & subclavian behind corresponding sterno-clavicular articulation.

RIGHT INNOMINATE — An inch & a half long, some what smaller than the left, and nearly vertical. Lies superficial & external to innominate artery, and is separated externally from right lung by right phrenic nerve & pleura. Joins with left innominate just below cartilage of 1st rib to form superior cava. Receives:

Right Lymphatic Duct – At its origin, in angle of junction between right subclavian vein & right internal jugular.

Tributary Branches: – *Right Vertebral, Internal Mammary, Inferior Thyroid, & Superior Intercostal.*

LEFT INNOMINATE — Three inches long, & somewhat larger than the right. Descends obliquely from behind left sterno-clavicular articulation to just below 1st costal cartilage of right side, lying in front of innominate, left common carotid & subclavian arteries, and behind sterno-hyoid & -thyroid muscles, remains of thymus gland, & sternum. Receives

Thoracic Duct – At its origin, in angle of junction between left subclavian vein & left internal jugular.

Tributary Branches: *Left Vertebral, Internal Mammary, Inferior Thyroid, Superior Intercostal,* and sometimes some small *Thymic & Pericardiac Veins.* – The innominate veins have no valves.

SUPERIOR VENA CAVA — Short thick trunk (2½ to 3 inches long), slightly curved, & convex to the right. Descends vertically along right side of ascending portion of arch of aorta & in front of root of right lung from just below 1st costal cartilage of right side, enters fibrous bag of pericardium about an inch and a half above the heart, becomes invested anteriorly by serous layer on the same bag, and opens into upper & front part of right auricle; is separated externally from right lung by right phrenic nerve & pleura, and its anterior relations are the same as those of the innominate. – Receives

Tributary Branches: – *Vena Azygos Major,* and some small *Pericardiac & Mediastinal Veins.* – Has no valves.

INTERNAL MAMMARY ARTERY.

From under surface of subclavian, opposite thyroid axis.

Downwards behind phrenic nerve and internal jugular & subclavian veins to posterior aspect of costal cartilages a short distance from sternum.

Descends between thoracic wall & pleura, giving off branches: –

Perforating, Anterior Intercostal, Anterior Mediastinal, & Comes Nervi Phrenici,

and divides between 6th & 7th costal cartilages & beneath triangularis sterni into branches

Musculo-phrenic, & Superior Epigastric.

Its two venæ comites unite into one trunk before they open into the innominate.

PERFORATING – Forwards through five or six upper intercostal spaces to pectoralis major, integument, and mamma.

ANTERIOR INTERCOSTAL —— Outwards in five or six upper intercostal spaces between internal intercostal muscles & pleura, and divide between internal & external intercostal muscles into superior & inferior branches which inosculate with corresponding branches of corresponding aortic intercostals, and are similarly distributed.

ANTERIOR MEDIASTINAL – Small, irregular; to pericardium, remains of thymus gland & cellular tissue of anterior mediastinum.

COMES NERVI PHRENICI (SUPERIOR PHRENIC) – From upper part of artery. Long, slender; with phrenic nerve to diaphragm, and anastomose with musculo-phrenic, & inferior phrenic from abdominal aorta.

MUSCULO-PHRENIC – Downwards & outwards behind cartilages of false ribs, supplying diaphragm, which it perforates opposite 8th or 9th rib, & abdominal muscles, and giving off a small anterior intercostal branch to each of the lower intercostal spaces.

SUPERIOR EPIGASTRIC – Enters sheath of rectus posteriorly, and anastomoses with epigastric branch of external iliac, lower intercostals & lumbar; gives twigs to rectus & to integument of middle line of abdomen.

THE PERICARDIUM.

Fibro-serous sac containing the heart & the commencement of the large vessels.

The serous layer forms a common sheath to the aorta & pulmonary artery as far as about two inches from their origin. It is then reflected upon the anterior aspect of the venæ cavæ & pulmonary veins, and upon the inner surface of the fibrous layer. – Marshall's "vestigial fold of the pericardium" containing the remains of the left superior cardinal vein of the embryo, may be seen in front of the root of the left lung.

The fibrous layer is prolonged upon the great vessels of the root of the neck, and becomes continous superiorly with the deep layer of the deep cervical fascia, that is to say with the layer of fascia which encloses the omo-hyoid muscles, the carotid vessels, & the trachea.

The pericardium is conical in shape, and presents : –

Anterior Aspect – Covered by loose areolar tissue & remains of thymus gland, lungs, pleuræ, middle piece of sternum, and costal cartilages of the left side from the 3rd to the 7th.

Posterior Aspect – In contact with roots of the lungs, œsophagus & descending aorta.

Lateral Aspects – Covered by pleuræ, and crossed by phrenic nerve & superior phrenic vessels.

Apex · Directed upwards upon great vessels.

Base – Attached to central or cordiform tendon, & to left anterior costal fibres of diaphragm.

THE HEART.

Lies within the pericardium, between the two lungs, behind the lower two-thirds of the sternum, and projects about three inches into the left side, & one into the right side of the thorax. – It presents:

Base – Formed by the auricles, attached to the great vessels, directed upwards backwards & to the right; corresponds to the interval between the 5th & 8th dorsal vertebræ.

Apex – Formed by the point of the left ventricle, directed downwards, forwards & to the left; corresponds to the 5th intercostal space of the left side, two inches below and one to the inner side of the nipple.

Anterior Surface – Formed chiefly by right ventricle, the anterior interventricular groove lying near the left border; convex, looks upwards & forwards, and extends from level of upper borders of third costal cartilages to a line drawn from lower end of gladiolus to situation of apex.

Posterior Surface – Formed chiefly by left ventricle, the posterior interventricular groove lying near the right border; flattened; rests upon diaphragm.

Right Border – Long, thin, rests upon diaphragm; formed by right ventricle.

Left Border – Short thick, much less inclined than the right one; formed by left ventricle.

THE ARCH of the AORTA.

From upper part of left ventricle to left side of lower border of body of 4th dorsal vertebra (some authors say 3rd, some say 5th), describing a curve, the convexity of which is directed upwards & to the right. Is divided into: –

ASCENDING PORTION — About two inches long. Upwards, forwards, & to the right from opposite centre of sternum on a level with lower border of 3rd costal cartilages to upper border of 2nd costal cartilage of right side close to sternum. Contained in pericardium together with trunk of pulmonary artery. – RELATIONS:

IN FRONT – Pulmonary artery, right auricular appendix, pericardium, loose areolar tissue, remains of thymus gland, sternum.
BEHIND – Right pulmonary vessels, & root of right lung.
TO THE RIGHT – Superior vena cava, right auricle.
TO THE LEFT – Trunk of pulmonary artery.

TRANSVERSE PORTION — Backwards & to the left from upper border of 2nd costal cartilage of right side close to sternum to left side of body of 3rd dorsal vertebra (some authors say 2nd, some say 4th). – RELATIONS:

IN FRONT – Left pneumogastric & phrenic nerves, cardiac branches of sympathetic, left lung & pleura.
BEHIND – Trachea, œsophagus, thoracic duct, left recurrent laryngeal nerve, great or deep cardiac plexus.
ABOVE – Left innominate vein, innominate, left common carotid, & left subclavian arteries.
BELOW – Left bronchus, right pulmonary artery, left recurrent laryngeal nerve, remains of ductus arteriosus.

DESCENDING PORTION — Along left side of 3rd & 4th to lower border of 4th dorsal vertebra (some authors say along left side of 2nd & 3rd to lower border of 3rd, some say along left side of 4th & 5th to lower border of 5th), where it becomes thoracic aorta. – RELATIONS:

IN FRONT – Pleura, root of left lung.
BEHIND – Body of 4th dorsal vertebra (some authors say of 3rd, some say of 5th).
TO THE RIGHT – Œsophagus, thoracic duct.
TO THE LEFT – Left lung & pleura.

The aorta is somewhat dilated just above its origin, where it presents externally three small bulgings corresponding to the sinuses of Valsalva; two of these bulgings are anterior, and one is posterior; and from the two anterior ones the coronary arteries are seen to arise. The most prominent part of the arch lies about $\frac{1}{4}$ of an inch behind the posterior surface of the sternum. The height to which the arch usually rises in the chest is about 1 inch below the upper border of the sternum.

BRANCHES — Left or Anterior, & Right or Posterior Coronary, Innominate, Left Common Carotid, Left Subclavian.

THE THORACIC AORTA.

Commences at left side of lower border of 4th dorsal vertebra (some Authors say 3rd, some say 5th). Descends through posterior mediastinum, curving slightly forwards and inclining slightly to the right, and ends at aortic opening of diaphragm in front of 12th dorsal vertebra. – RELATIONS:

In Front – Root of left lung, pericardium, œsophagus.
Behind – Vertebræ, vena azygos minor.
To the Right – Œsophagus (above), vena azygos major, thoracic duct.
To the Left – Left lung & pleura, œsophagus (below).

BRANCHES:

Pericardiac – Small, irregular; forwards to pericardium.

Bronchial – The nutrient vessels of the lungs. On left side, generally two arising from thoracic aorta one above the other; on right side, but one usually arising either from first aortic intercostal, or from front of aorta in common with artery of left side. Along back of corresponding bronchus, dividing & subdividing upon bronchial tubes, and supplying bronchial glands & cellular tissue of lung; give a few twigs to œsophagus.

Œsophageal – Usually four or five from front of aorta. Descend obliquely upon œsophagus anastomosing with each other, and with the œsophageal branches of the inferior thyroid, inferior phrenic & gastric.

Posterior Mediastinal – Small irregular branches to glands and cellular tissue of mediastinum.

Aortic Intercostals – From back of aorta. Usually ten in number, sometimes only nine, the second intercostal space being sometimes supplied, as well as the first, by the superior intercostal branch of the subclavian. To corresponding intercostal space, passing on

Left Side – Beneath smaller azygos & left superior intercostal veins, and left cord of sympathetic;

Right Side – Round bodies of vertebræ beneath œsophagus, thoracic duct, greater azygos, & right cord of sympathetic, – and divide into anterior & posterior branches.

Anterior Branch, or Intercostal Proper – Upon external intercostal muscle and beneath pleura & a thin layer of fascia, to lower border of rib above, and divides between the two intercostal muscles into branches:

Superior – The larger; along groove on inner surface of rib above;
Inferior – The smaller; along upper border of rib below, – which branches supply intercostal muscles, and anastomose with thoracic branches of axillary & anterior intercostal branches of internal mammary.

The three last intercostals are prolonged between abdominal muscles, and anastomose with epigastric, inferior phrenic & lumbar; the first one anastomoses with superior intercostal. – In the intercostal spaces the vein usually lies above the trunk of the artery & its superior branch, and the nerve below.

Posterior or Dorsal Branch – Backwards on inner side of superior or long costo-transverse ligament with posterior branch of corresponding spinal nerve, and divides into branches:

Spinal – Through intervertebral foramen to cord & its membranes and posterior aspect of bodies of vertebræ.

Muscular – Divides into *internal offset* to multifidus spinæ & integument near spine, and *external offset*, which passes between sacro-lumbalis & longissimus dorsi to superficial muscles & integument.

INNOMINATE ARTERY.

From commencement of horizontal portion of arch of Aorta in front of left common carotid. Upwards & to the right to upper border of right sterno-clavicular articulation, where divides into right common carotid & right subclavian. Gives off occasionally the thyroidea ima. Its length is usually from an inch to an inch & a half.—RELATIONS:

In Front — Sternum, sterno-hyoid & -thyroid, remains of thymus gland; Left innominate & right inferior thyroid veins; Inf. cervical cardiac br. of right pneumogastric.

Behind — Trachea.

On Inner Side — Left common carotid, remains of thymus gland.

On Outer Side — Right pneumogastric n., right innominate vein, pleura.

Thyroidea Ima — Is very variable in size, when present. Usually arises from innominate, sometimes from right common carotid or from Aorta. Ascends in front of trachea to thyroid gland.

COMMON CAROTID ARTERY.

Right common carotid arises from innominate artery behind sterno-clavicular articulation. Left common carotid arises from highest part of arch of Aorta, is longer, and has a thoracic portion deeply situated within the thorax.

THORACIC PORTION OF THE LEFT COMMON CAROTID ART.

Upwards & outwards to root of neck. — RELATIONS:

In Front — Sternum, sterno-hyoid & -thyroid, left innominate v., remains of thymus gland.

Behind — Trachea, œsophagus, thoracic duct.

On Inner Side — Innominate artery.

On Outer Side — Left pneumogastric & phrenic ns. & left subclavian art., left lung & pleura.

SUBCLAVIAN ARTERY.

From innominate artery behind upper border of sterno-clavicular articulation (right side), from end of transverse portion of arch of Aorta (left side), to outer border of first rib. Divided into three parts: –

FIRST PART — From origin to inner border of scalenus anticus. Differs on the two sides.

RIGHT SIDE — Arches upwards & outwards across root of neck, and is shorter & more superficial than on left side. – RELATIONS:

In Front – Sterno-clavicular articulation, sterno-mastoid, -hyoid, & -thyroid, deep layer of fascia; – and the artery is crossed by: Internal & anterior jugular and vertebral veins, pneumogastric & phrenic nerves, and cardiac branches of sympathetic.

Behind – Longus colli, transverse process of 7th cervical vertebra, cord of sympathetic, recurrent laryngeal nerve.

Below – Pleura.

SUBCLAVIAN VEIN lies below & in front of artery immediately behind clavicle.

LEFT SIDE — Ascends nearly vertically, and is longer & more deeply situated. – RELATIONS:

In Front – Same, plus left lung & pleura, left innominate v., left com. carotid; – and Pneumogastric & phrenic nerves & cardiac branches of sympathetic are nearly parellel to the artery.

Behind – Same, plus œsophagus & thoracic duct.

On Inner S.–Trachea, æsophagus, thoracic duct, left common carotid artery.

On Outer S.–Pleura.

BRANCHES — **Vertebral, Internal Mammary, Thyroid Axis** – Arise close together near inner border of scalenus anticus, an interval measuring usually from ½ an inch to 1 inch being left between the origin of the artery & its first branch. On the left side the **Superior Intercostal** also usually arises from this part of the artery.

PNEUMOGASTRIC NERVE.

Arises from lateral tract of medulla oblongata below glosso-pharyngeal & above spinal accessory. — Its deep origin is from a grey nucleus on floor of fourth ventricle.
Through jugular foramen behind glosso-pharyngeal & in same sheath as spinal accessory.
Presents two ganglia, one in and one below jugular foramen:
SUP. OR JUGULAR G. OR G. OF THE ROOT — Small, greyish, rounded. Anastom. with *facial, glosso-pharyngeal, spinal accessory & sympathetic.*
INF. G. OR G. OF THE TRUNK — Reddish, cylindrical, nearly an inch in length. Anastom. with *hypoglossal, spinal accessory, sympathetic, loop between two first cervical nerves.*
Descends behind & between int. & comm. carotid arteries & int. jugular v. and in same sheath;
Then,

ON RIGHT SIDE:
Between subclavian art. & v. and along side of trachea to back of root of lung, where spreads out into posterior pulmonary plexus.
Along side of œsophagus in the shape of two or more separate cords, which form œsophageal plexus with nerve of opposite side.
As a single cord along back of œsophagus to posterior surface of stomach, and joins solar & splenic plexuses.

ON LEFT SIDE:
Between and in front of left comm. carotid & left subclavian arteries behind left innominate vein.
Across arch of aorta to back of root of lung, where similarly spreads out and joins with its fellow.
Along side of œsophagus as above.
As a single cord along front of œsophagus to anterior surface of stomach, and joins left hepatic plexus.

BRANCHES:

Auricular Br. — Arises from g. of the root, and joins with glosso-pharyngeal.
Across jugular fossa & through opening in temporal bone near styloid process;
Between mastoid process & ext. audit. meatus to integument of back of pinna.
Gives off:
ASCENDING BR., which joins trunk of facial in aqueductus Fallopii;
DESCENDING BR., which joins auricular branch of facial.

Pharyngeal Br. — Arises from upper part of ganglion of the trunk;
Crosses internal carotid art. either in front or behind;
Anast. with glosso-pharyngeal, sup. laryngeal & sympathetic, and forms pharyngeal plexus to muscles & mucous membrane of pharynx.

Sup. Laryngeal N. — Arises from middle of ganglion of the trunk.
Descends by side of pharynx behind int. carotid artery, and divides into:
EXT. LARYNGEAL BR. — Joins with pharyngeal plexus & sup. cardiac nerve, and supplies crico-thyroid & inf. constrictor.
INT. LARYNGEAL BR. — Pierces thyro-hyoid membrane to arytenoid muscle and mucous membrane of larynx, base of tongue & aryteno-epiglottidean folds.

Recurr. Laryngeal N. — Ar. in front of, and passes below & behind, subclav. art. on right side, arch of aorta, on left, giving twigs to deep cardiac plexus;
Behind comm. carotid & inf. thyroid arteries, and in groove between trachea & œsophagus.
Beneath inf. constrictor to all the muscles of the larynx except crico-thyroid.
Gives brs. to inf. constrictor, and anastomoses with ext. laryngeal

Cardiac Brs. — Divided into:
CERVICAL CARDIAC, THORACIC CARDIAC } Vide Nerves of the Heart.

Pulmonary Brs. — Divided into ANTERIOR and POSTERIOR, and form the ant. & post. pulmonary plexuses. (Vide nerves of the lung.)

Œsophageal Brs. — Arise, some above, but most of them below, the pulmonary.

Gastric Brs. — Right pneumogastric supplies post. aspect of stomach and joins solar & splenic plexuses; left pneumog. supplies ant. aspect, and joins left hepatic plexus.

PHRENIC NERVE.

Phrenic or Int. Respiratory of Sir C. Bell – From 3rd, 4th, and usually also from 5th (cervical ns.
Downwards & inwards in front of scalenus anticus.
Between subclavian vein & 1st part of subclavian artery crossing internal mammary, and receiving a filament from sympathetic, sometimes another from 5th & 6th cervical nerves, and occasionally on the left side, one from the ansa hypoglossi.
Crosses arch of Aorta & pulmonary artery, on the left side.
Descends, on the right side, on outer side of right innominate vein & sup. vena cava.
In front of root of lung & along side of pericardium to diaphragm, and divides in to branches which perforate the diaphragm and supply it by its under surface.
Both nerves give off twigs to the pericardium & pleura, and join with the phrenic plexus of the sympathetic, the right nerve sending also a few filaments to the diaphragmatic ganglion.

CORONARY or CARDIAC VESSELS.

CORONARY OR CARDIAC ARTERIES — Two. From upper part of the bulgings corresponding to the two anterior sinuses of Valsalva just above free margin of semilunar valves.

Left or Anterior - The smaller. Forwards & to the left between pulmonary artery & left auricular appendix, and divides into branches:

HORIZONTAL - The smaller; along left auriculo-ventricular groove, and joins with horizontal branch of right or posterior coronary.

DESCENDING - The larger; along anterior interventricular groove to apex of heart, where it joins with descending branch of right or posterior coronary.

Right or Posterior - The larger. Forwards & to the right between pulmonary artery & right auricular appendix, and then backwards along right auriculo-ventricular groove, sending a large branch down right border of heart, and divides into branches:

HORIZONTAL - The smaller; along left auriculo-ventricular groove, and joins with horizontal branch of left or anterior coronary.

DESCENDING - The larger; along posterior interventricular groove to apex of heart, where it joins with descending branch of left or anterior coronary.

CORONARY OR CARDIAC VEINS.

Great Cardiac Vein - Ascends from apex of heart along anterior interventricular groove, turns backwards along left auriculo-ventricular groove, receiving an ascending branch of some size from left border of heart, and opens into left extremity of the coronary sinus, its opening being guarded by two valves.

Posterior Cardiac Vein - Ascends from apex of heart, where it communicates with preceding, along posterior interventricular groove, and opens into right extremity of coronary sinus, its opening being guarded by a valve. It receives the veins from the posterior surface of both ventricles.

Coronary Sinus - Thick trunk about an inch long situated at back part of left auriculo-ventricular groove, and partly covered & concealed by muscular fibres of left auricle. It receives the great & posterior cardiac veins, and a small vein, the remnant of the left superior cardinal vein of the embryo (Marshall), which passes downwards & to the right along back part of left auricle. It opens into the lower & back part of the right auricle close to the septum, below the opening of the inferior vena cava & Eustachian valve. Its opening is guarded by the valve of Thebesius.

Small or Anterior Cardiac Veins & Venæ Cordis Minimæ - Several small branches, which collect the blood from the anterior surface of the right ventricle, and from the muscular substance of the heart, and which open separately into the lower part of the right auricle (foramina Thebesii); one, larger than the others, runs along the right border of the heart.

THORAX.

II.

PULMONARY VESSELS.

PULMONARY ARTERY.

Short thick trunk about two inches long, which conveys the venous blood from the right side of the heart to the lungs.

Arises from apex of infundibulum of right ventricle opposite upper border of 3rd costal cartilage of left side close to sternum.

Upwards, backwards & to the left, winding spirally in front & then to the left of ascending portion of arch of aorta, the two vessels being contained in one tubular sheath of the serous layer of the pericardium. – On either side of the artery are the auricular appendices & the coronary arteries; behind it are the aorta & the left auricle.

Pierces fibrous layer of pericardium, and divides below & in front of transverse portion of arch of aorta into: –

Right Pulmonary Artery – The larger & longer. To the right behind ascending aorta & superior vena cava to root of right lung, in which it lies, both from before backwards and from above downwards, between the pulmonary veins & the bronchus. Divides into:

SUPERIOR BRANCH – The smaller, to superior & middle lobes.
INFERIOR BRANCH – The larger, to inferior lobe.

Left Pulmonary Artery – The smaller & shorter, connected at its root by remains of ductus arteriosus to under surface of arch of aorta. To the left in front of descending aorta, lying, in root of left lung, above the veins & the bronchus, but behind the former & in front of the latter. Divides into:

SUPERIOR BRANCH – The smaller, to superior lobe.
INFERIOR BRANCH – The larger, to inferior lobe.

PULMONARY VEINS.

Usually four. Commence upon the intercellular passages & air-cells in the capillary network of the pulmonary artery, but are also continuous with some of the terminal ramifications of the bronchial arteries.

Their smaller divisions are but very little larger than the corresponding branches of the pulmonary artery, and they accompany these singly, and form a single trunk for each lobule.

Their larger branches are destitute of valves, and form a single trunk for each lobe, the trunk from the middle lobe of the right lung uniting with that from the upper.

The two trunks from right lung pass behind superior vena cava, right auricle & ascending aorta, and those from left lung cross anteriorly the descending aorta; all are invested anteriorly by serous layer of pericardium.

In the lung the pulmonary vessels are generally found to lie in front of the corresponding bronchial tubes, the artery being above the vein. In the roots of the lungs the pulmonary veins lie in front of the arteries, and the arteries in front of the bronchus; and the order from below upwards is *veins*, *artery*, *bronchus*, on the right side, *veins*, *bronchus*, *artery*, on the left. There is sometimes a small distinct vein for middle lobe of right lung. The two left pulmonary veins often unite into one trunk.

THE LUNGS.

Light, porous, crepitant, elastic.

Of a pinkish white at birth, of a mottled slate colour in the adult; the mottling becoming darker & darker as age advances. Smooth & shining, marked out by dark lines into polygonal spaces corresponding to the bases of the superficial lobules, which spaces are variously crossed by other more delicate lines.

Conical in shape, and present : –

Outer Surface – Convex, deepest behind. Presents on either side a deep fissure oblique downwards & forwards from near apex to base, and, on the right side, another fissure oblique upwards & forwards from the middle of the foregoing. By these fissures the left lung is divided into two lobes, the right one into three; the inferior lobe is the largest in both lungs, and the middle lobe of the right side, the smallest of all.

Inner Surface – Concave, deeply excavated in front, especially on the left side, to make room for the heart; presents the hilum a little above & behind its middle.

Anterior Border – Thin, oblique, shorter than the posterior, deeply notched inferiorly on the left side so as to expose the pericardium; comes in contact with its fellow behind middle of sternum, the pleuræ alone being interposed.

Posterior Border – Thick, rounded, vertical, longer than the anterior.

Base – Broad, concave, oblique downwards & backwards; rests upon diaphragm, and its circumference fits into the groove between the diaphragm & the ribs. Descends lower down on the left side than on the right.

Apex – Passes up into root of neck an inch or an inch & a half above first rib, and, under cover of the scaleni, comes into close contact with first & second portions of subclavian artery.

The Right Lung is the *shortest* in consequence of the diaphragm ascending higher on the right side than on the left; the *broadest* owing to the inclination of the heart to the left; and somewhat the *largest*. – The Left Lung is the *longest*, *narrowest*, and somewhat the *smallest*.

THE ROOT of the LUNG

Consists of the bronchus, pulmonary & bronchial vessels, lymphatic vessels & glands, and pulmonary plexuses of the pneumogastric & sympathetic, which parts are all enclosed in a pleural sheath, and are bound together by areolar tissue in the following order:

From Before Backwards

On Either Side: –
Pulmonary veins with the *anterior pulmonary plexus*;
Pulmonary artery;
Bronchus with the *bronchial vessels*, *lymphatics vessels & glands*, *and the posterior pulmonary plexus*.

From Below Upwards

On Right Side – *Pulmonary veins*, *pulmonary artery*, *bronchus*, with &c.
On Left Side – *Pulmonary veins*, *bronchus*, *pulmonary artery*.

THE ROOT OF THE RIGHT LUNG — Lies behind the superior vena cava & the right auricle; the vena azygos major arches over it from behind.

THE ROOT OF THE LEFT LUNG — Passes beneath the arch of the aorta; behind it are the descending portion of the arch, the œsophagus & the thoracic duct. – The root of each lung has also in front of it the phrenic nerve, and behind it, the pneumogastric.

THE PLEURA.

Surrounds the lung, lines the parietes of the thorax, and forms the lateral boundary of the mediastina.

Tracing it horizontally from the sternum it passes: –

Over costal cartilages, ribs, & intercostal spaces;
Forwards along side of posterior mediastinum;
Outwards over posterior aspect of root of lung;
Round posterior part of inner surface, posterior border, outer surface, anterior border, anterior part of the inner surface of lung, dipping into the fissures between the lobes,
Inwards over anterior aspect of root of lung;
Forwards along side of pericardium to sternum.

Inferiorly it covers the diaphragm, from which a thin triangular fold, the *ligamentum latum pulmonis*, passes up along the side of the pericardium to the inner surface of the lung & to the lower border of its root.

Superiorly it ascends into the neck an inch or an inch & a half above the first rib, and, under cover of the scaleni, comes in contact with the first & second portions of the subclavian artery.

It is thinnest & most adherent over the lung & over the diaphragm. It is thickest & least adherent over the thoracic walls. Its inner surface is covered by a layer of pavement epithelium, and is moistened by a serous fluid.

Its arteries are from the intercostals, internal mammary, phrenic, inferior thyroid, pericardiac, & bronchial. – Its veins correspond to its arteries. – The lymphatics of the visceral layer join with those of the lung; the lymphatics of the parietal layer join with those of the mediastina & the thoracic walls. – Its nerves are derived from the pulmonary plexuses (Kölliker), and from the phrenic & sympathetic nerves (Lushka).

The two pleuræ come in contact behind the middle of the sternum.

THE MEDIASTINUM.

Is the antero-posterior septum comprised between the two lungs & pleuræ. It is divided into three parts by the pericardium, heart, & large vessels.

Anterior Mediastinum – Is the part in front of the pericardium, heart, & large vessels. It is narrow above, where it contains the remains of the thymus gland, the origins of the sterno-hyoid & -thyroid, the upper part of the left internal mammary vessels, a large quantity of loose areolar tissue, & a few lymphatic glands. It is narrower still behind the middle piece of the sternum, where the two pleuræ come in direct contact as low down as the 4th costal cartilage. Quite inferiorly, in consequence of the notch in the lower part of the anterior border of the left lung, it expands to the left behind the 4th & 5th intercostal spaces of the left side; here it contains the lower part of the left internal mammary vessels, & that part of the triangularis sterni muscle, which overlies the apex of the heart.

Middle Mediastinum – Is the part which contains the pericardium, heart & large vessels (ascending aorta, pulmonary vessels, superior vena cava; – the inferior vena cava enters pericardium through opening in cordiform tendon of diaphragm), and also the phrenic nerves. It is the widest part of the mediastinum.

Posterior Mediastinum – Is the part behind the pericardium, heart, & large vessels. It contains the descending aorta, trachea, œsophagus; the venæ azygos major & minor & the left superior intercostal; the pneumogastric & splanchnic nerves; the thoracic duct; fat & lymphatic glands.

Superior Mediastinum.—In the Ninth Edition of *Quain's Anatomy*, Professor Thane cuts off the upper part of the mediastinum as hitherto described to form the Superior Mediastinum. "The Superior Mediastinum may be considered "as bounded below by a plane passing through the lower part of the body of the "fourth dorsal vertebra behind, and the junction of the manubrium with the body "of the sternum in front. Its upper limit corresponds with the superior aperture "of the thorax. In front are the manubrium and the lower ends of the sterno-"hyoid and sterno-thyroid muscles; and behind are the upper four dorsal "vertebræ and the lower ends of the longus colli muscles. It contains the trachea, "œsophagus and thoracic duct; the whole of the transverse part of the arch of "the aorta, the innominate artery, and those parts of the left common carotid "and subclavian arteries which are contained within the thorax; the innominate "veins and upper part of the superior vena cava; the phrenic and pneumo-gastric "nerves, the left recurrent, and the cardiac nerves; and the cardiac lymphatic "glands and remains of the thymus gland."—(*Quain's Anatomy*, Vol. II., p. 477.)

THE TRACHEA & BRONCHI.

THE TRACHEA.

From 5th cervical vertebra to 3rd dorsal. Firm, rounded, & supported by cartilaginous rings in front, flattened & membranous behind.

Relations.

In Front –

Isthmus of thyroid gland, inferior thyroid veins, & thyroidea ima artery (when the latter exists).

Remains of thymus-gland, left innominate vein, arch of aorta with innominate & left common carotid arteries, great or deep cardiac plexus, bifurcation of pulmonary artery.

Sterno-hyoid & -thyroid, anastomotic branch between the anterior jugular veins, sternum, fascia, & skin.

Behind –

Œsophagus, which deviates to the left towards lower part of neck; right recurrent laryngeal nerve.

On Either Side –

Lateral lobe of thyroid gland; common carotid artery, internal jugular vein, pneumogastric & sympathetic nerves; inferior thyroid artery, left recurrent laryngeal nerve (the right nerve lies somewhat behind the trachea).

Innominate & common carotid arteries, pneumogastric & left recurrent laryngeal nerves; – and farther off, but internally to the pleuræ, right innominate vein & right phrenic nerve, on the right side, left subclavian artery & left phrenic nerve, on the left.

THE BRONCHI

Commence opposite the 3rd dorsal vertebra a little to the left of the middle line; the internal septum which marks the separation of the two tubes being slightly deviated to the left by the preponderance in diameter of the right bronchus over the left one. Both divide in the root of the lung into a large inferior and a somewhat smaller superior branch, the former of which, on the right side, gives off a small branch to the middle lobe of the right lung.

RIGHT BRONCHUS – About an inch in length, wider, more horizontal than the left one; enters root of lung opposite 4th dorsal vertebra. – It lies behind the superior vena cava & the right auricle; the right pulmonary artery lies at first below it, and then in front of it; the vena azygos major arches over it from behind.

LEFT BRONCHUS — Smaller, more oblique, nearly two inches long; enters root of lung opposite 5th dorsal vertebra. – It passes beneath the arch of the aorta; the left pulmonary artery lies at first above it, and then in front of it; behind it are the descending portion of the arch, the œsophagus & the thoracic duct.

THE ŒSOPHAGUS.

Commences in middle line of neck opposite 5th cervical vertebra & lower border of cricoid cartilage.

Downwards & to the left behind trachea, left lobe of thyroid gland & left recurrent laryngeal nerve, coming into close contact with left common carotid.

Downwards & to the right behind lower end of trachea & commencement of left bronchus, and between arch of aorta & thoracic duct on the left & the vena azygos major on the right, regaining middle line opposite 5th dorsal vertebra.

Again to the left between heart & pericardium in front and lower part of thoracic aorta behind, being surrounded by the pneumogastrics, which tend, the left one to the front, the right one to the back.

Through œsophageal opening of diaphragm, and opens into stomach (cardiac or œsophageal opening) opposite 9th dorsal vertebra.

Is from 9 to 10 inches long.

THE VENÆ AZYGOS.

Collect the blood from the intercostal spaces, and are three in number, the major, minor, & left superior.

VENA AZYGOS MAJOR, or RIGHT AZYGOS — Commences in the right ascending lumbar vein, or sometimes in a branch from the inferior cava or the right renal.

Through aortic opening of diaphragm on right side of thoracic duct, behind & on right side of aorta; – sometimes through right crus.

Along right side of spine in front of right intercostal arteries to 3rd dorsal vertebra.

Arches forwards over root of right lung, and opens into superior vena cava just before it enters pericardium. Receives:

Tributary Branches: – *Nine or ten lower intercostal veins of right side, vena azygos minor, several small œsophageal, mediastinal & spinal veins, the right bronchial,* sometimes the *right superior intercostal,* and occasionally the *left one.*

VENA AZYGOS MINOR, or LEFT LOWER AZYGOS — Arises in left ascending lumbar vein, or sometimes in a branch from left renal.

Perforates left crus of diaphragm (passes sometimes through aortic opening), and ascends along left side of spine in front of left intercostal arteries to 6th or 7th dorsal vertebra.

Crosses spine behind aorta & thoracic duct, and opens into vena azygos major. Receives:

Tributary Branches: – *Four or five lower intercostal veins of left side, several small mediastinal, œsophageal & spinal veins.*

LEFT UPPER AZYGOS — Receives the blood from those left intercostal veins, usually two or three in number, which are situated between the intercostal veins that open into the left lower azygos and those that open into the left superior intercostal. It therefore varies greatly in size, diminishing as these latter veins increase, & *vice versa;* often it does not exist at all, or one or more of the 5th, 6th, & 7th left intercosal veins may merely open directly into the vena azygos major. When there is a distinct left upper azygos, it opens either into the azygos major, or into the left lower azygos. ~ A few imperfect valves are found in the main azygos vein; distinct valves are found in the intercostal veins.

THE THORACIC & RIGHT LYMPHATIC DUCTS.

THORACIC DUCT — Commences in receptaculum chyli, passes through aortic opening of diaphragm, and then ascends in front of spine as high as 4th dorsal vertebra, lying behind œsophagus, between aorta & vena azygos major. It then inclines to the left, and ascends first behind arch of aorta and then behind first portion of subclavian artery of left side; and finally, opposite upper border of 7th cervical vertebra, it arches forwards above pleura & in front of scalenus anticus, and opens into angle of junction between left internal jugular & subclavian veins, its opening being guarded by a pair of valves. It is somewhat tortuous in its course, constricted at intervals on account of the valves it contains; of the size of a goose-quill at its commencement, somewhat narrower in the thorax, again enlarged at the root of the neck. Sometimes it bifurcates, its left division taking the usual course, its right division joining the right lymphatic duct. – It is the common trunk of all the lymphatics of the body, except those of the right side of the head, neck, & thorax, right upper limb. right lung, right side of the heart, & part of the convex surface of the liver.

Receptaculum Chyli - Is a dilatation of the commencement of the thoracic duct, which lies in front of the 2nd lumbar vertebra, behind & to right side of the aorta, and between it and the vena azygos major & the right crus of the diaphragm. It receives the trunks of the lacteal vessels, and four or five large trunks from the lumbar lymphatic glands.

RIGHT LYMPHATIC DUCT — Is a short thick trunk from half an inch to an inch in length and of about a line or a line & a half in diameter, which collects the lymph from the right side of the head, neck, & thorax, right upper limb, right lung, right side of the heart, & part of the convex surface of the liver. It opens into the angle of junction between the right internal jugular & right subclavian veins, its opening being guarded by a pair of valves.

SUPERIOR INTERCOSTAL ARTERY.

From upper & back part of 1st portion of subclavian on left side, of 2nd portion on right side. Passes backwards for a short distance, and gives off its deep cervical branch; it then descends in front of neck of 1st rib, or in front of necks of 1st & 2nd ribs on outer side of 1st dorsal ganglion of sympathetic, gives off one or two branches similar to the aortic intercostals, and joins with the first of the latter arteries.

Deep Cervical or Profunda Cervicis – Sometimes arises directly from subclavian. Backwards between neck of 1st rib & transverse process of 7th cervical vertebra, and ascends between complexus & semispinalis colli, anastomosing with vertebral artery & deep branch of arteria princeps cervicis.

INTERIOR of the HEART.

RIGHT SIDE.

Is larger in its auricular portion, and has thinner walls than the left.

AURICLE — Divided into:

Appendix Auriculæ – Narrow indented pouch, which overlaps the arch of the aorta, and presents on its inner surface the *musculi pectinati*, which extend somewhat into the sinus.

Sinus – The central cavity; presents: –

Opening of the Superior Vena Cava – Somewhat smaller than that of the inferior cava; situated at the upper & front part; looks downwards & forwards, and has near it the

Tubercle of Lower – Small eminence, scarcely visible in man, situated on right wall of auricle between the two venæ cavæ.

Opening of the Inferior Vena Cava – Somewhat larger than that of the superior cava; situated at the lower & back part near the septum; looks upwards & inwards, and presents the

Eustachian Valve – Semilunar in form with concave free, and convex attached margins; situated below the opening of the inferior vena cava between it & the auriculo-ventricular opening, and passes upwards & to the left to the anterior margin of the annulus ovalis. Small in the adult. Contains a few muscular fibres.

Opening of the Coronary Sinus – Situated below the opening of the inferior vena cava & the Eustachian valve. Presents the

Coronary Valve or Valve of Thebesius.

Foramina Thebesii – Some of which are the openings of the venæ cordis minimæ, while others are but small blind depressions.

Auriculo-Ventricular Opening – With the tricuspid valve (Vide below).

Foramen Ovale – In the fœtus. Situated at the lower & back part of septum above opening of inferior vena cava; replaced in adult by the

Fossa Ovalis – Oval depression surrounded by a prominent circular rim, the *Annulus Ovalis*, – and which often presents a small valvular opening at its upper part.

VENTRICLE — Triangular in shape, and has much thinner walls than the left one. Prolonged upwards & to the left into the *Infundibulum or Conus arteriosus*. Presents: –

Auriculo-Ventricular Opening – Oval, broadest from side to side. Situated behind the centre of the sternum on a level with the 3rd costal cartilages, on the right side of the aortic & left auriculo-ventricular openings. Guarded by the

Tricuspid Valve – Presents three triangular segments, which are attached superiorly to the margin of the auriculo-ventricular ring & laterally to each other, and of which the left one is the largest. They are formed by a central fibrous lamina attached superiorly to the fibrous ring of the opening and covered by a duplicature of the endocardium. Their under surface & borders give attachment to the *chordæ tendineæ*.

Opening of the Pulmonary Artery – Situated at the apex of the conus arteriosus opposite the upper border of the third costal cartilage of the left side close to the sternum. Guarded by the

Semilunar Valves – Three; formed of fibrous tissue surrounded by a duplicature of the endocardium, and present:

Convex margin – Attached to the fibrous ring of the orifice;

Free margin – Slightly concave, strengthened by a bundle of tendinous fibres, presenting in the centre a fibro-cartilaginous nodule, the *corpus Arantii*, and laterally two thin lunated portions, the *lunulæ*. Above the valves are three small pouches, the

Sinuses of Valsalva.

Columnæ Carneæ – Three sorts, which are attached respectively by one side, by both extremities, by one extremity only, to the wall of the ventricle. The latter are the

Musculi Papillares – Three or four; give origin to the *Chordæ Tendineæ.*

INTERIOR of the HEART.

LEFT SIDE.

Has thicker walls than the right, and is smaller in its auricular portion.

AURICLE — Divided, as is the right, into two parts, the

Appendix Auriculæ - Longer, narrower, more curved & indented than on right side, and constricted at its orifice; its musculi pectinati are smaller & less numerous. Overlaps pulmonary artery.

Sinus - More regularly cuboid than on right side. - Presents:

Openings of the Pulmonary veins - Four, at upper part, two on the right close to septum, two on the left, the latter sometimes uniting.

Auriculo-Ventricular Opening - With the Mitral valve (Vide below).

VENTRICLE — Rounded & conical; its walls are thicker than those of the right. Presents:

Auriculo-Ventricular Opening - Situated opposite centre of sternum on a level with third costal cartilages, between & behind the aortic & right auriculo-ventricular openings, or rather directly behind the aortic opening (Sibson). Somewhat smaller than on right side. Presents the

Mitral Valve - Larger, thicker & stronger than the tricuspid. Consists of two principal segments, of which the largest is in front. The chordæ tendineæ attached to its under surface are stronger & thicker, but are less numerous, than those on the right side.

Aortic Opening - Situated behind centre of sternum on a level with lower border of 3rd costal cartilage, and directly in front of the left auriculo-ventricular opening. Presents the

Semilunar Valves - Larger, thicker & stronger than those of pulmonary artery; lunulæ wider, corpora Arantii more prominent, and sinuses of Valsalva deeper.

Columnæ Carneæ - Those attached by one side and those attached by both extremities are smaller & more numerous. The musculi papillares are but two in number, but are larger, and are attached, one to the anterior, the other to the posterior wall of the ventricle.

STRUCTURE of the HEART—1st Tablet.

Presents for examination the fibrous rings of the arterial & auriculo-ventricular openings, and the muscular fibres.

FIBROUS RINGS — The aortic & the two auriculo-ventricular rings lie close together behind the centre of the sternum on a level with the 3rd costal cartilages, and are bound together by a fibro-cartilaginous mass which becomes ossified in some of the larger animals. – The aortic ring lies in front of the left auriculo-ventricular; the right auriculo-ventricular ring lies between, & to the right of, the two others. – The fibrous ring of the pulmonary artery is situated at the apex of the infundibulum opposite the upper border of the 3rd costal cartilage of the left side close to the sternum.

These rings give attachment to the mitral ,tricuspid & semilunar valves, to the muscular fibres of the auricles, and to some of the most superficial fibres of the ventricles. The margin of the arterial rings which is turned towards the auricles, is scalloped into three semilunar notches filled up by corresponding projections of the middle coat of the artery, the attachment of the arteries to the rings being strengthened externally by the pericardium and internally by the endocardium.

MUSCULAR FIBRES — Are striated, but are about ⅓ smaller than those of striated muscles generally, and their striation is not so distinct. They divide and anastomose with each other, and they often contain fat cells. Their perimysium is but scanty.

Fibres of the Auricles - Are mostly transverse, superficial, & common to both auricles; some however lie deeper, and are proper to each auricle.

Superficial, Transverse, or Common Fibres – Surround mainly the base of the sinuses, and are most marked anteriorly. Some dip into the inter-auricular septum.

Deep or Proper Fibres – May be divided into:

Looped Fibres – Arch over each auricle from before backwards, and are attached to the auriculo-ventricular rings both in front & behind.

Annular Fibres – Encircle the appendices auriculæ, and the venæ cavæ, pulmonary & coronary veins, extending for some distance upon the veins.

Fibres of the Ventricles - Vide next Tablet.

STRUCTURE of the HEART—2nd Tablet.

FIBRES OF THE VENTRICLES

Form seven layers differing from each other by the direction of their fibres.

These layers are continuous with each other at the apex & at the base of the heart as follows: – the 1st, or most external layer, with the 7th, or most internal layer.
„ 2nd, „ 6th,
„ 3rd, „ 5th,
The fibres of the 4th or central layer return upon those of the same set.

Together, the 1st & 7th layers form a kind of double ring inclosing all the other layers; the 2nd and 6th layers, a kind of double ring inclosing the 3rd, 4th, and 5th layers; the 3rd and 5th layers, a kind of double ring inclosing the 4th layer. As a consequence the double ring formed by the 1st and 7th layers extends farther towards the apex & the base of the heart than the double ring formed by the 2nd & 6th layers, which latter double ring extends farther than the double ring formed by the 3rd & 5th layers; and the 4th or central layer is the least extensive of all. This explains the greater thickness of the walls of the ventricles towards the middle of their length than at either extremity. – The outer layers, it may be added, are thinner than the inner ones.

The fibres of the three outer layers are inclined downwards & to the left on the anterior aspect of the heart, downwards & to the right on the posterior aspect; and they become less vertical in each successive layer. The fibres of the 4th layer are horizontal or transverse. The fibres of the three inner layers are inclined upwards & to the left on the anterior aspect of the heart, upwards & to the right on the posterior aspect, crossing the fibres of the three outer layers, and becoming more & more vertical or longitudinal in the successive strata.

Some of the superficial fibres, especially those of the posterior surface, pass round and enclose both ventricles; the mass of the fibres, however, enclose but one ventricle.

In the three outer layers the anterior fibres proper to the left ventricle issue from the inner & front part of the corresponding arterial & auriculo-ventricular openings & from the front of the interventricular septum; these anterior fibres pass downwards & to the left, with a few of the anterior common superficial fibres, and get to the back part of the apex. The posterior fibres proper to the left ventricle issue from the outer & back part of the corresponding arterial & auriculo-ventricular openings & from the back of the interventricular septum; these posterior fibres pass downwards & to the right, with a somewhat considerable number of the posterior common superficial fibres, and get to the front of the apex. Here all the fibres, both anterior & posterior, curl inwards in a whirl-like manner, the anterior fibres going to form the three inner strata on the posterior wall of the ventricle, and the posterior fibres going to form the three inner strata on the anterior wall.

In the right ventricle the fibres of the three outer layers issue partly from the corresponding arterial & auriculo-ventricular openings, and are partly continuous with the posterior common superficial fibres. Descending spirally from left to right on the posterior aspect of the heart, and from right to left on the anterior aspect, they reach the anterior interventricular groove. Here a few fibres are continued on to the left ventricle, forming the anterior common superficial fibres; the greater number pass backwards, however, in the interventricular septum, at the back of which they decussate with the fibres of the left ventricle, and blend with the posterior common super. superficial fibres.

It must be added that none of the fibres, except a few of the most superficial ones, can now be said to *arise* from the arterial & auriculo-ventricular rings. The strata are merely continued opposite these rings, the superficial ones into the deep ones, and *vice versa.*

NERVES of the HEART

Are derived from the cardiac plexuses, which plexuses are formed by the cardiac branches of the sympathetic and of the pneumogastric & recurrent laryngeal.

CARDIAC NERVES — Are the three cardiac nerves of the sympathetic, the cervical-cardiac & the thoracic-cardiac nerves of the pneumogastric, and the cardiac branches of the recurrent laryngeal.

CARDIAC NERVES OF THE SYMPATHETIC — Are three in number, *superior or superficial, middle or great, & inferior*, and arise normally *from* the corresponding *cervical ganglia.* The superior cardiac nerve, however, frequently arises partly from the communicating cord below the superior ganglion, and the inferior one partly from the first dorsal ganglion; when the middle ganglion is absent the middle cardiac nerve arises from the communicating cord between the superior & inferior ganglia.

These nerves pass downwards & inwards *to the base of the heart* either singly or in connection with each other or with the other cardiac nerves, varying considerably in their relative size and in their precise relations to adjoining structures; when one of them is smaller than usual one of the others is increased in size.

On the *right side* of the neck the *superior & the middle* cardiac nerves pass downwards *behind the common carotid* artery, the former passing also in front of the inferior thyroid artery & recurrent laryngeal nerve. They then *cross the subclavian artery* either in front or behind, and descend *upon the trachea to* the right side of the *great or deep cardiac plexus.* – On the *left side* the *superior cardiac nerve* usually descends into the thorax *between & in front of* the *left common carotid & left subclavian* arteries and crosses anteriorly the *arch of the aorta to* the *superficial cardiac plexus;* sometimes however it lies deeper than usual and then passes behind the aorta to the deep cardiac plexus. – The *left middle cardiac nerve* passes into the thorax *between & behind the left common carotid & left subclavian arteries,* and then descends *behind the arch of the aorta to* the left side of the *deep cardiac plexus.*

The *inferior cardiac nerve* passes downwards & inwards *to the deep cardiac plexus behind the subclavian artery,* and also, on the right side, behind the *innominate.*

CARDIAC NS. of the PNEUMOGASTRIC & RECURR. LARYNGEAL

Are divided into:

Cervical Cardiac – Are divided into:

Upper Cervical Cardiac – Small branches which join the cardiac nerves of the sympathetic.

Lower Cervical Cardiac – One large branch which, on the right side, descends along the innominate artery and joins one of the cardiac nerves destined to the deep cardiac plexus, and, on the left side, crosses the arch of the aorta to the superficial cardiac plexus.

Thoracic Cardiac – Arise on the right side both from the trunk of the pneumogastric & from its recurrent laryngeal branch, but on the left side from the recurrent branch only. They all go to the deep cardiac plexus either singly or in connection with the other deep cardiac nerves.

THE CARDIAC PLEXUSES.

The cardiac nerves form two primary cardiac plexuses termed the superficial & the deep or great, and two secondary plexuses, the anterior & the posterior coronary, which two latter plexuses are derived from the preceding, as are also in part the anterior & the posterior pulmonary plexuses.

SUPERFICIAL CARDIAC PLEXUS — The smaller. Is situated beneath arch of aorta in front of right pulmonary artery and on right side of ductus arteriosus. It communicates by several filaments with the left half of the deep cardiac plexus.

It is formed by the left superior cardiac nerve of the sympathetic, the left inferior cervical cardiac branch of the pneumogastric, and by several filaments from the deep cardiac plexus. It often presents a small ganglion, the ganglion of Wrisberg.

It gives off the greater part of anterior coronary plexus, and several filaments to anterior pulmonary plexus of left side.

DEEP OR GREAT CARDIAC PLEXUS — The larger. Is situated between trachea & arch of aorta, its right half lying above right branch of pulmonary artery, its left half lying rather on left side of trachea and being connected by several filaments with the superficial plexus.

It is usually formed by every one of the cardiac nerves excepting the left superior cardiac nerve of sympathetic & left inferior cervical cardiac nerve of pneumogastric.

Its right half sends branches – behind right pulmonary artery to posterior coronary plexus & to right auricle; – in front of right pulmonary artery, outwards, to right anterior pulmonary plexus, inwards, in front of pulmonary trunk to anterior coronary plexus. – Its left half gives off: – several filaments to superficial cardiac plexus, numerous filaments to posterior coronary plexus & to left auricle, a few branches to left anterior pulmonary plexus.

ANTERIOR CORONARY PLEXUS — Is derived chiefly from the superficial cardiac plexus, but partly also from the deep. It passes forwards between aorta & pulmonary artery and accompanies the left or anterior coronary artery & its branches.

POSTERIOR CORONARY PLEXUS — Is derived chiefly from the left half of the deep cardiac plexus, but partly also from the right. Its branches accompany the right or posterior coronary artery and its branches.

The filaments of the coronary plexuses ramify in the substance of the heart and beneath the pericardium & endocardium. Numerous small ganglia are found upon them, especially in the vicinity of the boundary rings between the auricles & ventricles.

SPLANCHNIC NERVES.

Usually three in number, and termed *great, lesser, & least.*

Arise as follows from the six or seven lower dorsal ganglia:

GREAT SPLANCHNIC NERVE – Ganglia from 5th or 6th to 9th or 10th: – Is also connected with the dorsal ganglia above as high as the 3rd, or sometimes even as high as the 1st.

LESSER SPLANCHNIC NERVE – 10th & 11th ganglia.

LEAST SPLANCHNIC NERVE – 12th ganglion.

Pass downwards & inwards upon bodies of vertebræ being either more or less separate & distinct from each other, or more or less plexiform, and frequently presenting, when plexiform, either one relatively large ganglion, the ganglion splanchnicum, or several smaller ones.

Perforate diaphragm conjointly or separately.

End, the two first mainly in solar plexus, the last mainly in the renal. – The majority of the fibres of the great splanchnic nerve descend directly to the semilunar ganglion of same side

The great splanchnic nerves are white & firm in texture, as are also the branches of the superior mesenteric plexus

GANGLIATED CORDS & GANGLIA of SYMPATHETIC.

GANGLIATED CORDS — Lie on each side & along the whole length of spinal column, converging inferiorly upon the coccyx in the ganglion impar, and being prolonged superiorly into the head along internal carotid artery. They are usually single, sometimes double, occasionally wanting here & there. Relatively to the size of the ganglia they are largest in the dorsal region. They are divided into:

Cervical Portion – Lies in front of transverse processss of cervical vertebræ behind internal jugular vein, and presents three ganglia (Vide Cervical portion of Sympathetic).

Thoracic Portion – Lies in front of heads of ribs & intercostal vessels, beneath pleuræ, on outer side of venæ azygos, at first at a small distance from, and then close to, bodies of vertebræ. It presents eleven or twelve ganglia.

Lumbar Portion – Penetrates into abdomen, on right side through a small opening in right crus of diaphragm, on left side either through aortic opening or through a small separate opening in left crus. It lies in front of bodies of vertebræ on inner side of psoas, behind inferior vena cava on the right side, behind abdominal aorta on the left. It presents four or five ganglia.

Sacral Portion – Lies in front of sacrum on inner side of anterior sacral foramina, and, converging towards its fellow inferiorly, usually ends in the ganglion impar.

PREVERTEBRAL GANGLIA — Usually three cervical, eleven or twelve dorsal, four or five lumbar, four sacral, one coccygeal. More or less oval or triangular in shape, and elongated from above downwards.

Cervical – Vide cervical portion of sympathetic.

Dorsal – Lie most of them in front of heads of ribs, the nine or ten first at a little distance from, the two or three last close to, bodies of corresponding vertebræ; occasionally one or two ganglia lie opposite the corresponding intervertebral foramina. They are smaller than the cervical & lumbar. The first one is the largest and is often blended with the inferior cervical. The last one is usually stellate in shape, and is sometimes blended with the first lumbar. – They present:

ROOTS, OR BRANCHES OF COMMUNICATION WITH THE DORSAL NERVES – Usually two in number: – Either both ascend obliquely upwards & outwards to join the dorsal nerve above just before its bifurcation, or one ascends as above described, and the other descends to join the dorsal nerve below in corresponding situation. Sometimes one or two ganglia have a third root resulting from bifurcation of one of the roots to adjoining dorsal nerves, and even, occasionally, an additional root to second dorsal nerve above.

INTERNAL BRANCHES, OR BRANCHES OF DISTRIBUTION – Those from five or six upper ganglia are small & greyish; they mainly supply thoracic aorta & its branches, & bodies of vertebræ & their ligaments; those from third & fourth ganglia join posterior pulmonary plexus. Those from six or seven lower ganglia are larger & whiter; they give off a few small branches to aorta, and join to form the great, lesser, & last splanchnic nerves (V. Solar Plexus).

Lumbar – Rather larger & more distinct than the dorsal, and situated at a greater distance from the corresponding intervertebral foramina, the first one often lying opposite body of second lumbar vertebra, and the last one opposite sacro-vertebral articulation. – They present:

ROOTS, OR BRANCHES OF COMMUNICATION WITH THE LUMBAR NERVES – Two or three for each. Are longer & more slender than those of dorsal ganglia, and pass beneath the fibrous arches of psoas in company with lumbar arteries & veins.

INTERNAL BRANCHES, OR BRANCHES OF DISTRIBUTION – Give a few twigs to bodies of vertebræ & their ligaments, and assist in forming the aortic & hypogastric plexuses.

Sacral – Smaller than the dorsal & lumbar, and diminish in size as they descend; lie close to inner side of anterior sacral foramina, those of opposite sides approximating as they descend, and usually blend in front of coccyx in a median ganglion, the coccygeal ganglion or ganglion impar. – They present

ROOTS, OR BRANCHES OF COMMUNICATION WITH THE SACRAL NERVES – Usually two for each ganglion; are short & small.

INTERNAL BRANCHES, OR BRANCHES OF DISTRIBUTION – Those of the two upper ganglia join inferior hypogastric or pelvic plexus; the others descend upon the arteria sacra media, and supply the sacrum & coccyx & their ligaments, and the coccygeal gland.

THE LARYNX.

THE LARYNX—1st Tablet.

CARTILAGES — Nine; three single, three pairs: -

THYROID — The largest. Consists of two quadrilateral plates or *alæ* joined in front at an acute angle, the highest & most prominent part of which angle is termed the *pomum Adami*. Presents:

Outer Surface - Presents on either side the *Oblique Line* - For sterno-thyroid & thyro-hyoid; passes obliquely downwards & forwards from tubercle near root of superior cornu. The surface behind gives attachment to inferior constrictor.

Inner Surface - Covered by mucous membrane externally & above. Presents in middle line the *Receding Angle* - To which are attached the true & the false vocal cords, the thyro-arytænoidei & -epiglottidei muscles, and the thyro-epiglottic ligament & apex of the epiglottis.

Upper Border - Deeply notched opposite pomum Adami, rounded & prominent on either side of notch, concave laterally; gives attach. to thyro-hyoid membr.

Lower Border - Shorter, straighter, connected to cricoid cartilage by crico-thyroid membrane & muscle.

Posterior Border - Thick & rounded; gives attachment to stylo- & palato-pharyngei, and is prolonged upwards & downwards respectively into the *Superior Cornu* - Long, narrow; points upwards, backwards & inwards, and gives attachment to lateral thyro-hyoid ligament. *Inferior Cornu* - Shorter & thicker; points downwards forwards & inwards, and presents internally a small facet for articulation with cricoid cartilage.

CRICOID — Annular in shape, broad behind, narrow in front; thicker & stronger, but smaller than foregoing. Presents:

Outer Surface - Gives attachment in front & at sides to crico-thyroideus & inferior constrictor; and then presents on either side from before backwards: *Tubercle* - Surmounted by an articular facet, for articulation with lesser cornua of thyroid cartilage; *Broad Rough Depression* - For attachment of crico-arytænoideus posticus; *Median Vertical Ridge* - For attachment of longitudinal fibres of œsophagus.

Inner Surface - Smooth, lined with mucous membrane of larynx.

Upper Border - Inclined downwards & forwards. Gives attachment in front & at sides to crico-thyroid membrane & crico-arytænoideus lateralis, and presents at its posterior & highest part, on either side of a slight median notch, two small oval facets for articulation with arytænoid cartilages.

Lower Border - Horizontal; connected to first cartilaginous ring of trachea by fibrous membrane of that canal.

ARYTÆNOID — Two, small, pyramidal. Rest upon posterior & highest part of upper border of cricoid cartilage, and present:

Anterior Surface - Convex, rough; gives attachment to false vocal cord & upper fasciculus of thyro-arytænoideus.

Posterior Surface - Excavated for attach. of arytænoideus.

Internal Surface - The narrowest, flattened, covered with mucous membrane.

Base - Broad. Presents a smooth concave facet for articulation with cricoid cartilage, and three angles, of which angles two are prominent & important, viz., *Antero-Internal Angle* - Long & pointed; gives attachment to true vocal cord & to lower fasciculus of thyro-arytænoideus. *Postero-Ext. Angle* - Short & rounded; gives attach. to the crico-arytænoidei lateralis & posticus.

Apex - Pointed, curved backwards & inwards; articulates on either side with the

CORNICULA LARYNGIS or CARTILAGES of SANTORINI — Two small conical nodules of yellow elastic cartilage sometimes joined to apices of arytænoid cartilages, which apices they prolong backwards & inwards.

CUNEIFORM CARTILAGES or CARTILAGES of WRISBERG — Two small rods of yellow elastic cartilage directed upwards & outwards in free border of arytæno-epiglottidean folds a little in front of arytænoid cartilages; their anterior extremity is slightly enlarged.

EPIGLOTTIS — Median lamella of yellow elastic cartilage in the form of a leaf with the stalk below, and the lamina or expanded part above. Presents:

Apex - Long & narrow; attached by thyro-epiglottic ligament to upper part of receding angle of thyroid cartilage.

Base - Broad, rounded, free.

Anterior Surface - Free in its upper part, where it curves forwards towards base of tongue, to which it is connected by the three glosso-epiglottic folds; adherent below, where it is attached by hyo-epiglottic ligament to upper border of hyoid bone.

Posterior Surface - Free, smooth, concave from side to side, convex from above downwards. Covers superior aperture of larynx during second act of deglutition, and is studded with numerous small pits for the reception of mucous glands.

Lateral Margins - Convex, directed backwards; connected to arytænoid cartilages by the arytæno-epiglottidean folds.

THE LARYNX—2nd Tablet.

LIGAMENTS — Are:

EXTRINSIC — Three; connect larynx to hyoid bone. – They are:

Thyro-Hyoid Membrane – Broad fibro-elastic membrane from
Upper border of thyroid cartilage to
Upper border of hyoid bone, being separated from posterior surface of hyoid bone by a little loose cellular tissue in which a bursa is usually found. It is thickest towards middle and perforated laterally by superior laryngeal vessels & nerves. Behind it are the epiglottis & the mucous membrane of the base of the tongue, with a considerable amount of adipose tissue & some mucous glands.

Lateral Thyro-Hyoid Ligaments – Rounded fibro-elastic cords from
Superior cornua of thyroid cartilage to
Extremities of greater cornua of hyoid bone. – These ligaments often contain a small cartilaginous nodule, the *cartilago triticea.*

INTRINSIC — Connect cartilages of larynx as follows: On the one hand the cricoid to the thyroid & arytænoid, on the other the epiglottis to the thyroid. – They are:

Crico-Thyroid Membrane – Yellow elastic lamina divided into:
CENTRAL PORTION – Thick, triangular, broadest below; connects
Contiguous margins of cricoid & thyroid.
LATERAL PORTIONS – Thinner; extend from
Upper border of cricoid cartilage as far back as crico-thyroid arthrodia to
Lower border of inferior or true vocal cord, uniting firmly with the latter, especially in front. – The central portion is concealed by crico-thyroid muscles, except in mesial line, and is crossed by crico-thyroid branches of superior thyroid arteries; the lateral portions are covered by the thyro- & lateral crico-arytænoid muscles, and are lined internally by mucous membrane of larynx.

Crico-Thyroid Capsules – Thin, strongest behind; enclose the arthrodial articulations between cricoid & inferior cornua of thyroid, and are lined internally with synovial membrane.

Posterior Crico-Arytænoid Ligament – Short but strong band from
Back of cricoid cartilage to
Back of base of arytænoid.

Crico-Arytænoid Capsules – Thin; surround the arthrodial articulations between upper border of cricoid cartilage & bases of the arytænoid, and are lined internally with synovial membrane.

Thyro-Epiglottic Ligament – Long & slender band connecting
Apex of epiglottis to
Upper part of receding angle of thyroid.

Hyo-Epiglottic Ligament – Somewhat indistinct; extends amidst a considerable amount of adipose tissue from
Anterior surface of epiglottis to
Upper border of hyoid bone.

To the foregoing ligaments must be added the superior & inferior thyro-arytænoid described with the vocal cords, and the somewhat indistinct fibro-cartilaginous capsules frequently found between the arytænoid cartilages & the cornicula laryngis.

THE LARYNX—3rd Tablet.

MUSCLES of the GLOTTIS — Are four on each side, and one in the middle line.

Crico-Thyroideus – Front & sides of cricoid cartilage.
Lower border & inferior cornu of thyroid cartilage. – S. by superior laryngeal nerve.
Tilts the thyroid cartilage forwards, and thus elongates & tenses the vocal cords.

Thyro-Arytænoideus – Lower part of receding angle of thyroid cartilage, & posterior surface of crico-thyroid membrane.
By two fasciculi into anterior surface of arytænoid cartilage, and into anterior or internal angle of its base. – S. by recurrent laryngeal nerve.
Draws the arytænoid cartilage forwards, and thus shortens and relaxes the vocal cord ; it also assists in compressing the sacculus laryngis. The former action is that of its lower & stronger fasciculus, which lies parallel with, & on the outer side of, the inferior or true vocal cord; the latter action is that of its upper & thinner fasciculus, which lies on the outer side of the sacculus laryngis.

Crico-Arytænoideus Lateralis – Side of upper border of cricoid cartilage.
External or posterior angle of base of arytænoid cartilage. – S. by recurrent laryngeal nerve.
Rotate the arytænoid cartilages so as to bring together their anterior or internal angles & the true vocal cords which are attached to them, and thus constrict the glottis.

Crico-Arytænoideus Posticus – Broad depression on side of posterior surface of cricoid cartilage.
External or posterior angle of base of arytænoid cartilage. – S. by recurrent laryngeal nerve.
Rotate the arytænoid cartilages so as to separate their anterior or internal angles & the true vocal cords which are attached to them, and thus dilate the glottis.

Arytænoideus – Posterior surface & outer border of both arytænoid cartilages, presenting superficial oblique & deep transverse fibres. – S. by both the superior & the inferior or recurrent laryngeal nerves.
Bring together the two arytænoid cartilages, and thus constrict the glottis, especially in its posterior part. – Sometimes a small fasciculus, the *Kerato-cricoideus* (Merkel), extends, below the preceding, from the cricoid cartilage to the inferior cornu of the thyroid cartilage.

MUSCLES of the EPIGLOTTIS — Are three in number.

Thyro-Epiglottideus or Depressor Epiglottidis – Inner surface of the thyroid cartilage externally to origin of thyro-arytænoid.
Margin of epiglottis & arytæno-epiglottidean fold.
Depresses the epiglottis, and assists in compressing the sacculus laryngis.

Arytæno-Epiglottideus Inferior or Compressor Sacculi Laryngis – Arytænoid cartilage just above false vocal cord.
Margin of epiglottis.
Depresses the epiglottis, and assists in compressing the sacculus laryngis.

Arytæno-Epiglottideus Superior – Apex of arytænoid cartilage.
Arytæno-epiglottidean fold.
Constricts the superior aperture of the larynx during the second act of deglutition. – The oblique fibres of the arytænoideus are sometimes considered as belonging to the arytæno-epiglottidei, which muscles would then decussate in the middle line behind the horizontal fibres of the arytænoideus, or arytænoideus proper.

THE LARYNX—4th Tablet.

MUCOUS MEMBRANE

Is stretched, on entering the larynx, between the arytænoid cartilages & the epiglottis, forming the *arytæno-epiglottidean folds*. These contain the thyro- & the arytæno-epiglottidean muscles, the cornicula laryngis & the cartilages of Wrisberg, and a large amount of loose cellular tissue, the occasional infiltration of which tissue constitutes the so-called œdema of the glottis.

It is thin, and of a pale rosy colour. It is particularly thin & adherent over the epiglottis, and still more so over the true vocal cords, where it is transparent enough for the ligamentous fibres to be seen through its substance.

Its epithelium is columnar ciliated below the superior vocal cords, and also, in front, as high as the middle of the epiglottis; above these points it loses its cilia, and gradually assumes the squamous form. It is squamous over the true vocal cords.

It is highly sensitive in the upper part of the larynx.

MUCOUS GLANDS — Simple tubular, and conglomerate; particularly abundant over the posterior surface of the epiglottis, in which situation they are received into numerous small pits in the substance of the cartilage; but they are found everywhere beneath the mucous membrane, excepting over the true vocal cords. The glands of the sacculus laryngis, from 60 to 70 in number, pour out their secretion upon the inferior or true vocal cords which it is destined to lubricate. The so-called *arytænoid glands* are collected into a somewhat large mass in the arytæno-epiglottidean folds, in front of the arytænoid cartilages.

VESSELS & NERVES — ARTERIES. Are the laryngeal branches of the superior & inferior thyroid. – VEINS. Open into the superior, middle & inferior thyroid. – LYMPHATICS. Terminate in the deep cervical glands. – NERVES. Are the superior and the inferior or recurrent laryngeal branches of the pneumogastric, and filaments from the sympathetic. The superior laryngeal nerve supplies the mucous membrane, the crico-thyroid muscle, & in part the arytænoid; the inferior or recurrent laryngeal nerve supplies in part the arytænoid, and all the other muscles, excepting the crico-thyroid.

THE LARYNX—5th Tablet.

INTERIOR of the LARYNX.

Is divided in two by the glottis or rima glottidis.

GLOTTIS or RIMA GLOTTIDIS — Antero-posterior opening comprised between the inferior or true vocal cords in its anterior three-fourths, and between the arytænoid cartilages in its posterior fourth.

In tranquil breathing it is triangular with base backwards. It is lozenge-shaped when fully dilated, as in violent inspirations. It is reduced to a narrow slit when sound is emitted; the vocal cords then lying parallel to each other, and their degree of approximation & tension increasing with the height of the sound produced.

In the adult male it is nearly an inch long, and may be dilated to nearly half an inch. In the female, and in the male before puberty, its dimensions are about one-third less.

Inferior or True Vocal Cords – Extend from near middle of receding angle of thyroid cartilage below the false vocal cords to anterior or internal angle of the base of the arytænoid cartilages. They consist of a strong band of yellow elastic fibrous tissue, the *inferior thyro-arytænoid ligament*, which band is continuous inferiorly with the lateral portion of the crico-thyroid membrane, is covered internally by a very thin & adherent layer of mucous membrane, and is strengthened externally by the thyro-arytænoid muscle.

PART ABOVE the GLOTTIS — Is broad & triangular, & presents for examination: –

Superior Aperture of the Larynx – Triangular, obliquely inclined downwards & backwards, and bounded in front by the epiglottis, & laterally by the arytæno-epiglottidean folds.

Superior or False Vocal Cords – Extend from near middle of receding angle of thyroid cartilage above the true vocal cords to the anterior surface of the arytænoid cartilages; they consist of a fold of mucous membrane containing a thin band of yellow elastic fibrous tissue, the *superior thyro-arytænoid ligament*, from which a delicate expansion extends over the sacculus laryngis. They bound superiorly the opening of the

Ventricle of the Larynx – Deep oblong saccular depression comprised between the superior & inferior vocal cords, and corresponding externally to the thyro-arytænoid muscle. It is continued superiorly & in front by a narrow opening into the

Sacculus Laryngis or Laryngeal Pouch – A prolongation of the foregoing, which passes upwards & forwards between the superior vocal cord & the thyroid cartilage, and is covered externally by the thyro-epiglottideus & by the thin upper fasciculus of the thyro-arytænoid, and internally by the arytæno-epiglottideus inferior or compressor sacculi laryngis. The mucous lining of the pouch is supported by an expansion from the superior vocal cord, and presents the openings of from 60 to 70 mucous glands, whose secretion lubricates the inferior vocal cords.

PART BELOW the GLOTTIS — Is flattened from side to side above, circular below, continuous inferiorly with canal of trachea.

THE NERVE CENTRES & THEIR COVERINGS.

COVERINGS of the BRAIN & CORD—1st Tablet.

The immediate coverings of both are three in number, and though presenting marked differences, they bear the same names, *dura mater, arachnoid & pia mater.*

THE DURA MATER — Is a thick. dense, fibrous membrane, which is lined internally by a stratum of squamous epithelial cells formerly called the parietal layer of the arachnoid.

Dura Mater of the Brain - Forms the internal periosteum of the skull; it is prolonged round all the cranial nerves, blending with their sheaths and becoming at their point of exit continuous with the pericranium; it is also prolonged into the orbit.

Its outer surface is rough & fibrillated; it is most adherent opposite the sutures at the base of the skull, and presents superiorly numerous glandulæ Pacchionii.

Its inner surface is smooth; it sends three processes inwards, the *falx cerebri* and the *tentorium & falx cerebelli*, in the attached margins of which processes are respectively contained the superior longitudinal, the lateral & superior petrosal, & the occipital sinuses, the falx cerebri having also the inferior longitudinal sinus in its free margin.

Its arteries are derived from the middle & small meningeal, and from the meningeal branches of the anterior & posterior ethmoidal, internal carotid, ascending pharyngeal, occipital & vertebral, which arteries however supply principally the bones of the skull. Its veins, with the exception of the two which accompany the middle meningeal, join with the diploic veins and open into the sinuses. – Its nerves are small branches from the fourth cranial nerve, the Casserian ganglion, the ophthalmic branch of the fifth, the eighth, & the sympathetic.

Dura Mater of the Cord - Differs from that of the brain in that it does not form the internal periosteum of the bodies & laminæ of the vertebræ, which periosteum is a distinct fibrous membrane separated from the dura mater by loose areolar tissue & by a plexus of veins, in that it sends no prolongations inwards, contains no sinuses, and forms, especially in the cervical & lumbar regions, but a loose sheath round the cord and the roots of the spinal nerves.

It is attached *superiorly* to the circumference of the foramen magnum, and *anteriorly* it is slightly adherent along its whole length to the posterior common ligament of the spine.

Laterally when viewed from *within*, it is seen to give attachment to the processes of the ligamentum denticulatum, and to present a double series of foramina for the passage of the anterior & posterior roots of the nerves; when viewed from *without* it is seen to form a separate sheath to the roots of the nerves as far as their point of junction, and then to be continued upon the nerves, forming part of their neurilemma.

Opposite the *termination of the cord* it blends with the pia mater to form the ligamentum centrale, which passes down to the back of the coccyx, and which, in its upper part, contains the filiform prolongation of the grey matter of the cord termed the filum terminale.

COVERINGS of the BRAIN & CORD—2nd Tablet.

THE ARACHNOID

Surrounds the brain & cord, from which it is separated by the sub-arachnoidean space.

Arachnoid of the Brain — On the upper surface of the hemispheres it is thin & transparent, and passes over the convolutions without dipping into the sulci. – At the base of the brain it is thicker and slightly opaque. Crossing from side to side between the two temporo-sphenoidal lobes and between the two hemispheres of the cerebellum & the medulla oblongata, it bounds inferiorly the *anterior & posterior subarachnoidean spaces.*

It is reflected round the cranial nerves in the shape of loose sheaths as far as their point of exit from the skull, where it becomes continuous with the parietal layer.

Arachnoid of the Cord — Forms, especially in the lower part, but a loose sheath round the cord & the roots of the nerves.

This sheath is single round the two roots of each spinal nerve, and is continued as far as their exit from the dura mater; the arachnoid is also reflected over the processes of the ligamentum denticulatum.

THE SUBARACHNOIDEAN SPACE

Is comprised between the pia mater & the visceral layer of the arachnoid, and contains the cerebro-spinal fluid. It usually communicates with the general ventricular cavity of the brain by an opening in the layer of pia mater which bounds the fourth ventricle inferiorly.

It is narrow on the surface of the hemispheres, but is greatly expanded both at the base of the brain in the situation of the anterior & posterior subarachnoidean spaces, and also round the spinal cord.

It is crossed by numerous fibrous bands in the situation of the ba e of the brain and at the upper part of the back of the cord, and is partly subdivided by an incomplete membranous septum which connects the arachnoid with the pia mater opposite the posterior median fissure.

COVERINGS of the BRAIN & CORD—3rd Tablet.

THE PIA MATER

On the cerebrum & cerebellum the pia mater is a delicate areolar membrane, very thin & vascular. It is thick, dense, and but slightly vascular, on the pons, the crura cerebri & the cord.

It is everywhere intimately adherent to the nervous substance; it dips down between the convolutions of the cerebrum and the laminæ of the cerebellum, and passes into the anterior and posterior median fissures of the cord; it is prolonged upon the nerves and their roots.

The pia mater of the brain penetrates into the ventricular cavities through the transverse fissure, and forms the velum interpositum and the choroid plexuses. – It usually presents an opening at the lower extremity of the fourth ventricle, by which opening the subarachnoidean space of the brain & cord communicates with the ventricular cavities of the brain.

The pia mater of the cord presents anteriorly the linea splendens, a whitish longitudinal fibrous band, and laterally, the ligamentum denticulatum. This latter descends along the whole length of the side of the cord between the anterior & the posterior roots of the nerves; its outer edge is denticulated; the denticulations, about twenty-two in number, cross the subarachnoidean space with the arachnoid reflected over them, and become attached to the dura mater in the intervals of the successive pairs of spinal nerves. The first denticulation is situated opposite the foramen magnum, between the vertebral artery & the hypoglossal nerve. — Opposite the termination of the cord the pia mater blends with the dura mater to form the ligamentum centrale, which latter passes down to the back of the coccyx, and, in its upper part, contains the filiform prolongation of the grey matter of the cord, termed the filum terminale.

The cerebral hemispheres are now described as presenting five lobes: the frontal, parietal, occipital & temporo-sphenoidal lobes, and the central lobe or Island of Reil. These lobes are seen most extensively on the upper or convex surface of the hemispheres.

UPPER OR CONVEX SURFACE OF THE CEREBRUM: — Presents:

FOUR PRINCIPAL FISSURES — Which partly separate the five lobes:

ASCENDING & HORIZONTAL LIMBS OF THE FISSURE OF SYLVIUS — The former ascends in front of the central lobe and amongst the frontal convolutions.* — The latter passes backwards behind the central lobe, and separates the temporo-sphenoidal lobe from the frontal & parietal lobes.

FISSURE OF ROLANDO — Begins near the middle of the longitudinal fissure and passes downwards & forwards to near the horizontal limb of the fissure of Sylvius, separating the frontal & parietal lobes.

EXTERNAL PARIETO-OCCIPITAL FISSURE — Separates the parietal and occipital lobes above. — Is very variable in extent, and is sometimes scarcely recognisable except by its being continuous with the internal parieto-occipital fissure, or perpendicular fissure of the inner surface of the hemispheres.

OUTER SURFACE OF THE FIVE LOBES:

Frontal Lobe — Presents:

ASCENDING FRONTAL CONVOLUTION — Forms the anterior boundary of the fissure of Rolando, and is continuous round the lower end of that fissure with the ascending parietal convolution. It is joined in front to the

SUPERIOR, MIDDLE & INFERIOR TRANSVERSE FRONTAL CONVOLUTIONS, — Which pass forwards one above the other to the anterior extremity of the hemisphere.

Parietal Lobe — Presents:

ASCENDING PARIETAL CONVOLUTION — Forms the posterior boundary of the fissure Rolando, and is continuous below round the lower end of that fissure, with the ascending frontal convolution. — Behind this convolution are three complex and variable convolutions termed the parietal lobule, the supra-marginal convolution & the angular gyrus.

PARIETAL LOBULE — Is situated on the side of the longitudinal fissure between the parieto-occipital fissure, & the fissure of Rolando, and, is continuous in front with the upper part of the ascending parietal convolution, and joined behind to the superior occipital by the first annectant convolution.

SUPRA-MARGINAL CONVOLUTION — Is situated below and in front of the preceding and in front of the angular gyrus. It is separated from the ascending parietal convolution by the intra-parietal fissure, and is connected behind with the angular gyrus.

ANGULAR GYRUS — Is situated behind the preceding, below and behind the parietal lobule. It blends below with the superior & middle temporo-sphenoidal convolutions, and is connected behind with the middle occipital by the second annectant convolution.

Temporo-Sphenoidal Lobe — Presents three well marked antero-posterior convolutions, which are superposed to each other.

SUP. TEMPORO-SPHENOIDAL CONVOLUTION — Lies between the horizontal limb of the fissure of Sylvius and the parallel fissure, and is continuous behind with the angular gyrus.

MIDDLE TEMPORO-SPHENOIDAL CONVOLUTION — Is separated from the lower one by the inferior temporo-sphenoidal fissure, and is continuous posteriorly with the angular gyrus and connected by the third annectant with the middle occipital convolution.

INF. TEMPORO-SPHENOIDAL CONVOLUTION — Is partly seen on the under surface of the cerebrum, and is connected behind to the third occipital by the fourth annectant convolution.

Occipital Lobe — Presents three rather badly defined convolutions, which are superposed to each other, and are more or less antero-posterior.

SUP. OCCIPITAL CONVOLUTION — Is connected to the parietal lobule by the first annectant convolution.

MIDDLE OCCIPITAL CONVOLUTION — Is connected to the angular gyrus & to the middle temporo-sphenoidal convolution by the second and third annectant convolutions.

INF. OCCIPITAL CONVOLUTION — Is connected to the inferior temporo-sphenoidal convolution by the fourth annectant convolution.

Central Lobe or Island of Reil — Is deeply situated between the frontal & temporo-sphenoidal lobes at the bottom of the outer part of the fissure of Sylvius. It presents five or six convolutions, which are nearly straight and mainly directed upwards and outwards, and of which the posterior ones are the largest.

*And is sometimes called the precentral sulcus.

UNDER SURFACE of the CEREBRUM

Presents from before backwards

IN THE MEDIAN LINE:

Anterior part of the Longitudinal Fissure – Bounded behind by the anterior extremity or genu of the corpus callosum.

Anterior Extremity or Genu of the Corpus Callosum – Curves downwards and backwards. Its narrowing reflected portion, beak or rostrum, is connected with the lamina cinerea, and gives off two white bundles, the peduncles, which cross the anterior perforated space to the entrance of the fissure of Sylvius.

Lamina Cinerea – A thin layer of grey substance stretching, above the optic commissure, with which it is connected, from the rostrum of the corpus callosum to the tuber cinereum, and continuous laterally with the grey matter of the anterior perforated space.

Optic Commissure or Chiasma with the **Optic Tracts** – Vide Optic Nerve.

Interpeduncular Space – Lozenge-shaped, comprised between the crura cerebri and the optic tracts, and containing from before backwards:

Tuber Cinereum with the Infundibulum & Pituitary Body – The former of which is a conical eminence of the grey matter of the floor of the 3rd ventricle connected by a hollow infundibuliform process, the infundibulum, with the latter, which latter is a small reddish grey vascular mass divided into an anterior & a posterior lobe, and the nature of which, especially in its anterior lobe, is very similar according to Dr. Sharpey, to that of the ductless or vascular glands. It is proportionately larger in the fœtus, and is then hollow, its cavity being continuous with that of the 3rd ventricle.

Corpora Albicantia – Two small round white bodies formed by the twisting upon themselves of the anterior crura of the fornix before they pass up to the optic thalami.

Posterior Perforated Space – Formed by a layer of grey substance, which constitutes the posterior part of the floor of the 3rd ventricle and is continuous around the corpora albicantia with the base of the tuber cinereum. It is perforated by numerous small foramina for the passage of blood vessels to the optic thalami.

Crura Cerebri – Vide Mesocephalon.

LATERALLY:

Under Surface of the Frontal Lobe – Presenting internally the lower end of the marginal convolution, on the outer side of which is the olfactory sulcus containing the olfactory nerve and bulb.

Anterior Perforated Space – Formed by a layer of grey substance corresponding to the under surface of the corpus striatum, and perforated by numerous small foramina for the passage of vessels to that body. It is bounded in front by the posterior and inner part of the frontal lobe and the roots of the olfactory nerve, and behind & to the inner side by the optic tract & commissure, and is continued externally into the

Fissure of Sylvius – Which separates the frontal and temporo-sphenoidal lobes and divides on the outer surface of the cerebrum into two branches or limbs, which enclose the central lobe or Island of Reil.

Under Surface of the Temporo-sphenoidal Lobe.

Behind these parts appear when the medulla oblongata & cerebellum are removed, in the median line:

Middle part of the Transverse Fissure – Comprised between the corpora quadrigemina and the

Posterior Extremity or Splenium of the Corpus Callosum – Behind which is the

Posterior Part of the Longitudinal Fissure – And laterally the

Under Surface of the Occipital lobe.

INNER SURFACE of the CEREBRUM

Presents for examination:

Marginal Convolution & Convolution of the Corpus Callosum separated from each other by the *Calloso-marginal Fissure;*
Quadrate & Occipital Lobules separated from each other by the *Internal Parieto-occipital Fissure*, and of which the latter is separated by the *Calcarine Fissure* from the internal temporo-sphenoidal convolutions;
Internal Temporo-sphenoidal Convolutions, three in number, superior (dentate convolution), middle (gyrus uncinatus) & inferior, and separated from the foregoing by the above-mentioned calcarine fissure and from each other by the *Dentate & Collateral Fissures.*

Marginal Convolution – Forms the lateral boundary of the anterior half of the longitudinal fissure. Beginning at the anterior perforated space, it first passes forwards on the inner side of the olfactory sulcus as far as the apex of the frontal lobe, and then curves upwards & backwards along the upper margin of the hemisphere to a little behind the fissure of Rolando.

Convolution of the Corpus Callosum or Gyrus Fornicatus – Begins anteriorly with the foregoing, and then winds backwards along the convex surface of the corpus callosum from which it is separated by the so-called ventricle. Posteriorly it joins above with the quadrate lobule, and then, becoming slightly constricted, is reflected downwards & forwards round the splenium and continued into the gyrus uncinatus.

Calloso-Marginal Fissure – Separates the two foregoing convolutions along their whole length, and then ascends to the upper margin of the hemisphere separating the marginal convolution from the quadrate lobule.

Quadrate Lobule – Quadrilateral. Bounded above, in front, & behind respectively by the margin of the hemisphere, and by the calloso-marginal & internal parieto-occipital fissures. Blends inferiorly with the gyrus fornicatus.

Occipital Lobule – Triangular. Bounded behind, in front, & below respectively by the inner margin of the hemisphere and by the internal parieto-occipital & calcarine fissures.

Internal Parieto-Occipital Fissure – Separates the two foregoing lobules. It is continuous superiorly with the external parieto-occipital fissure; inferiorly it joins with the calcarine fissure.

Calcarine Fissure – Extends horizontally forwards from the apex of the occipital lobe to the point of junction of the gyrus fornicatus with the gyrus uncinatus. It separates the occipital lobule from the middle temporo-sphenoidal convolution, and joins anteriorly with the internal parieto-occipital fissure.

Superior Temporo-Sphenoidal or Dentate Convolution – Is but a narrow band of grey matter which lies internally to the fascia dentata. It blends anteriorly with the uncus.

Dentate Fissure – Corresponds to the hippocampus major, and separates the dentate convolution from the gyrus uncinatus.

Middle Temporo-Sphenoidal Convolution or Gyrus Uncinatus – Comprised between the calcarine & collateral fissures, and extends along nearly the whole length of the temporo-sphenoidal lobe. It is slightly constricted towards its middle & enlarged in front & behind; anteriorly it presents a small hooked prolongation, the uncus, which curves upwards & backwards, and joins with the dentate convolution & with the corpus fimbriatum.

Collateral Fissure – Extends along nearly the whole length of the temporo-sphenoidal lobe, separating the gyrus uncinatus from the inferior temporo-sphenoidal convolution. It corresponds towards its middle to the eminentia collateralis.

Inferior Temporo-Sphenoidal Convolution – Appears both on the inner & under surfaces of the hemispheres, and is joined behind by the fourth annectant to the inferior occipital convolution.

INTERNAL STRUCTURE of the HEMISPHERES.

PARTS SEEN BEFORE OPENING THE VENTRICLES:

Centrum Ovale Minus – With the puncta vasculosa & the convoluted margin of the divided grey matter.

Ventricle of the Corpus Callosum – Comprised between the corpus callosum & the gyrus fornicatus.

Centrum Ovale Majus – Into which the fibres of the corpus callosum are continued on either side.

Corpus Callosum – Thick stratum of transverse & radiating white fibres which connect the two hemispheres; arched from before backwards, thickest & broadest behind, thinnest towards centre. It presents:

Upper Surface – Convex from before backwards, striated transversely, marked by a median depressed raphé which is bounded by two slightly elevated bands termed the *nerves of Lancisi*. More externally, beneath the gyrus fornicatus, are other similar bands, the *striæ longitudinales laterales*.

Under Surface – Blended behind with the fornix. In front, where it forms the roof of the lateral ventricles, it is connected with the fornix by the septum

Anterior Extremity or Genu – Curves downwards & backwards, presenting a narrowing reflected portion, the *beak or rostrum*. This latter is connected with the lamina cinerea, and gives off two small white bands or *peduncles*, which cross the anterior perforated space to the entrance of the fissure of Sylvius.

Posterior Extremity or Splenium – Thick & rounded. Forms upper boundary of middle portion of transverse fissure, and is joined in front with the fornix.

THE LATERAL VENTRICLES

Consist of a central cavity or body, and three prolongations or cornua.

Central Cavity or Body – Presents:

Roof – Formed by under surface of corpus callosum.

Inner Wall – Formed by septum lucidum, which contains the fifth ventricle.

Floor – Formed from before backwards by the *corpus striatum*, *tænia semicircularis*, *thalamus opticus*, *choroid plexus*, *corpus fimbriatum* & *fornix*.

Ant. Cornu – Passes downwards & outwards round anterior extremity of corpus striatum.

Post. Cornu or Digital Cavity – Curves backwards, downwards, outwards, and then backwards, downwards & inwards in substance of occipital lobe. On inner part of its floor is the hippocampus minor, a longitudinal eminence which corresponds to calcarine fissure of Huxley.

Middle or Descending Cornu – Curves backwards, outwards & downwards round optic thalamus, and then forwards & inwards to near anterior extremity of temporo-sphenoidal lobe. Its floor presents the *hippocampus major*, *pes hippocampi*, *pes accessorius*, *corpus fimbriatum*, *choroid plexus*, *fascia dentata* & *transverse fissure*.

PARTS SEEN on FLOOR of LATERAL VENTRICLE

Are from before backwards.

CORPUS STRIATUM — Large pear-shaped mass of grey matter embedded externally in white substance of frontal lobe. Presents:

ANT. EXTREMITY – Broad; projects into anterior part of body of lateral ventricle, forming part of its floor, and into anterior cornu of the same cavity.

POST. EXTREMITY – Narrow; passes backwards and outwards on outer side of optic thalamus.

The corpus striatum is divided into two portions, the intra- & extra-ventricular, by a layer or stratum of ascending & diverging white fibres which form the *pecten* or the *corona radiata of Reil.* Part of these fibres are derived from the inferior or fasciculated portion, and also from the upper part or tegmentum, of the crus cerebri; part of them originate in the corpus striatum.

TŒNIA SEMICIRCULARIS — Whitish semi-transparent band of fibres, which descends anteriorly in connection with anterior crus of fornix, and is lost posteriorly in descending cornu of lateral ventricle; it partly conceals the vena corporis striati.

OPTIC THALAMUS — Large ovoid mass of grey matter white superficially, similar to corpus striatum, behind & internally to which it is situated, and similarly traversed by numerous ascending & diverging white fibres, which are partly derived from upper portion of crus cerebri, olivary fasciculus, fasciculus teres, processus e cerebello ad testes & corpora quadrigemina, and which partly originate in the thalamus. Presents:

ANT. EXTREMITY – Narrow, situated behind anterior crus of fornix; forms posterior boundary of foramen of Monro.

POST. EXTREMITY – Broad & rounded. Projects into descending cornu of lateral ventricle, and is continuous on inner side with tubercula quadrigemina.

UPPER SURFACE – Anteriorly it forms part of floor of lateral ventricle, and presents a slight elevation, the anterior tubercle; posteriorly it is covered by fornix, which rests upon it.

UNDER SURFACE – Continuous with posterior rounded extremity. In its posterior part it forms roof of descending cornu of lateral ventricle, and presents two small eminences, the *corpora geniculata internum et externum*, which are connected respectively with inner & outer bands of origin of optic tract. In its anterior part it rests upon the crus cerebri, and is penetrated by the radiating fibres above mentioned.

INNER SURFACE – Forms lateral boundary of 3rd ventricle. Is joined to its fellow by the middle, soft, or grey commissure, and presents inferiorly the grey matter of the interior of the thalamus uncovered by the white. The superior peduncle of the pineal gland separates this surface from the upper.

OUTER SURFACE – Continuous anteriorly with posterior narrow extremity of corpus striatum, and embedded posteriorly in white substance of temporo-sphenoidal lobe.

CHOROID PLEXUS — The thick, convoluted & fringe-like margin of the velum interpositum. – Vide Velum interpositum.

CORPUS FIMBRIATUM or TÆNIA HIPPOCAMPI — The thin lateral margin of the posterior crus of the fornix.

FORNIX — Triangular longitudinal lamella of white matter broad behind, narrow in front, situated below corpus callosum with which it is joined behind, and to which it is connected in front by septum lucidum; forms roof of third & posterior part of floor of both lateral ventricles. Presents:

BODY – Presents:

Upper Surface – Joined behind with corpus callosum, and connected in front to the same by septum lucidum; forms posterior part of floor of both lateral ventricles.

Under Surface – Marked posteriorly by a few transverse & anteriorly converging fibres, which form the *lyra.* Forms centrally the roof of 3rd ventricle; rests laterally upon optic thalami. Is covered by velum interpositum.

ANTERIOR CRURA – Descend behind anterior white commissure & in front of optic thalamus, forming anterior boundary of foramen of Monro, and perforate grey substance of floor of 3rd ventricle to corpora albicantia, in which they twist upon themselves; they then ascend to corresponding optic thalamus.

POSTERIOR CRURA – Diverge into the descending cornua of lateral ventricles, becoming continuous with inner border of hippocampus major. Their thin lateral margin is the *corpus fimbriatum* or *tænia hippocampi.*

PARTS SEEN in DESCENDING CORNU of LATERAL VENTRICLE.

HIPPOCAMPUS MAJOR or CORNU AMMONIS – Is a white eminence which curves downwards, forwards, & inwards along floor of descending cornu of lateral ventricle, and which corresponds to the dentate fissure & to the reflected portion of the convolution of the corpus callosum or gyrus fornicatus, which portion has been described of late years as the anterior part of the *gyrus uncinatus*. It enlarges anteriorly, and ends in the

PES HIPPOCAMPI – The anterior rounded extremity of the hippocampus major; it more or less resembles the paw of an animal, being marked along its margin by slight notches or depressions separating rounded intervening elevations.

PES ACCESSORIUS or EMINENTIA COLLATERALIS – A small rounded eminence, simlar to the preceding, situated between the two hippocampi at junction of middle & posterior cornua. It corresponds to the collateral fissure.

CORPUS FIMBRIATUM or TÆNIA HIPPOCAMPI – The prolongation of the thin lateral margin of the posterior crus of the fornix; is continuous with inner border of hippocampus major.

CHOROID PLEXUS – Vide next Tablet.

FASCIA DENTATA – The grey serrated border of the dentate convolution, which is separated from the gyrus uncinatus by the dentate fissure of Huxley. It lies beneath the corpus fimbriatum & the margin of the choroid plexus.

TRANSVERSE FISSURE – Vide next Tablet.

TRANSVERSE FISSURE of the BRAIN & INTRA-CEREBRAL PORTION of PIA MATER.

TRANSVERSE FISSURE OF THE BRAIN

Is of a horse-shoe shape, and about 3 inches wide.
Its central part is horizontal and comprised between the tubercula quadrigemina & the posterior extremity or splenium of the corpus callosum.
Its lateral portions curve downwards & forwards, and are comprised between the optic thalami & crura cerebri below & in front and the hippocampi majores & corpora fimbriata above & behind.
This fissure transmits the pia mater into the interior of the brain.

INTRA-CEREBRAL PORTION OF THE PIA MATER

Forms on the one hand the velum interpositum & the choroid plexuses of the lateral & the 3rd ventricles, and, on the other, the choroid plexuses of the 4th ventricle.

Velum Interpositum – Is a triangular fold of pia mater which is reflected into the interior of the brain through the transverse fissure. It presents:

Central Portion – Invests pineal gland, and covers under surface of fornix. From the under surface of this central portion two small vascular fringes, the choroid plexuses of the 3rd ventricle, hang down into the latter cavity.

Lateral Margins – Spread out on either side beneath the corresponding margin of the fornix & its continuation, the corpus fimbriatum, into the body & descending cornu of the corresponding lateral ventricle, resting, as do the margins of the fornix, upon the optic thalami. These lateral margins are thick, convoluted & fringe-like; they constitute the choroid plexuses of the lateral ventricles further described below.

Posterior Margin or Base – Is turned backwards towards the transverse fissure. It is continuous with the general pia mater; it receives the anterior & posterior choroid arteries and emits the venæ Galeni.

Anterior Bifid Extremity – Continuous through the foramina of Monro with the anterior pointed extremities of the lateral margins above described or choroid plexuses of the lateral ventricles.

Choroid Plexuses of the Lateral Ventricles – Are nothing more than the thick, convoluted & fringe-like margins of the velum interpositum. When they are described separately, that is to say irrespectively of the velum interpositum of which they are a portion, they may be said to penetrate into the descending cornua of the lateral ventricle through the lateral portions of the transverse fissure. Hence they ascend into the body of the lateral ventricle along the side of the corpus fimbriatum, winding round the posterior extremity of the optic thalamus. Then continuing along the side of the fornix, they taper to a point, and passing through the corresponding foramen of Monro, they join with each other and with the anterior bifurcated extremity of the central & thinner portion of the velum interpositum.

Choroid Plexuses of the 3rd Ventricle – Are two small vascular fringes which hang down from the under surface of the central portion of the velum interpositum into the cavity of the 3rd ventricle; they diverge slightly behind.

Choroid Plexuses of the 4th Ventricle – Are two similar fringes which project into the 4th ventricle from the layer of pia mater which closes that ventricle inferiorly; they pass upwards & outwards from near the point of the inferior vermiform process to the outer margin of the restiform body.

THE THIRD VENTRICLE

is a narrow median fissure comprised between the optic thalami, and extending to the base of the brain. It presents:

Roof – Formed by under surface of fornix and by velum interpositum.

Floor – Corresponds to interpeduncular space on under surface of cerebrum, and is formed from before backwards by the lamina cinerea, tuber cinereum & infundibulum, corpora albicantia and locus perforatus posticus. It is oblique downwards & forwards, and is covered by a thick layer of grey matter. It presents in the fœtus the opening of the iter ad infundibulum.

Lateral Walls – Formed by inner surface of optic thalami, which surface is bounded above by superior peduncles of pineal gland, and is covered below by part of the grey matter of the third ventricle prolonged upwards from its floor. – The lateral walls are joined together by the middle or soft commissure, a transverse band of grey matter continuous with the remainder of the grey matter of the 3rd ventricle.

Ant. Extremity – Formed by anterior crura of fornix. In front of these is the anterior commissure, a transverse band of white fibres, which perforates laterally the corpora striata & spreads out into the substance of both hemispheres. – Between the crura & the optic thalami are the foramina of Monro, through which the lateral & 3rd ventricles communicate, and the anterior extremities of the velum interpositum pass from the 3rd into the lateral ventricles to form the choroid plexuses of the latter.

Post. Extremity – Formed by posterior commissure, a transverse band of white fibres connecting posteriorly the optic thalami. Below this is the opening of the iter a tertio ad quartum ventriculum, and above are the tubercula quadrigemina & the pineal gland.

For parts above mentioned see foregoing Tablets.

THE CEREBELLUM.

Oblong from side to side & flattened from above downwards. Presents two surfaces & a circumference, and consists of two lateral hemispheres connected by a median lobe, the vermiform process, which latter is divided into two parts, the superior & the inferior.

UPPER SURFACE — Flattened on either side, slightly elevated in the centre. Presents:

Superior Vermiform Process – Presents from before backwards three slight elevations, the

Lobulus Centralis, Monticulus Cerebelli, & Commissura Simplex, which latter joins with the commissura brevis of the inferior vermiform process.

Lateral Hemispheres – Divided by a deep fissure into

Anterior or Square Lobe, the anterior, inner & broader portion, and the Posterior or Semilunar Lobe, the narrow, posterior or marginal portion.

UNDER SURFACE — Rounded & elevated laterally and depressed in the centre. Presents:

Inferior Vermiform Process – Lies in a deep depression, the *valley* or *vallecula* comprised between the two hemispheres, and presents from behind forwards the

Commissura Brevis, Pyramid & Uvula, the former of which joins with the commissura simplex of the superior vermiform process.

The uvula is situated between the two *tonsils*, with which it is connected by a grey commissure the *furrowed band*. Its rounded apex, the *nodule* or *laminated tubercle of Malacarne* projects into the 4th ventricle, and is connected with the flocculi by a thin valvular fold of white substance, the *posterior medullary velum* or *commissura ad flocculum*, which fold is partly covered in & concealed by the tonsils.

Lateral Hemispheres – Present five lobes:

Flocculus, Sub-Peduncular Lobe, or Pneumogastric Lobule – Prominent tuft subdivided into several small laminæ and situated below & behind the middle peduncle of the cerebellum, behind the roots of the pneumogastric nerve.

Amygdala or Tonsil – Rather larger than foregoing and similarly subdivided; projects into the valley on either side of the uvula, to which it is connected by the furrowed band.

Digastric Lobe – Corresponds in situation to the anterior part of the square lobe of the upper surface.

Slender Lobe – Corresponds in situation to the posterior part of the foregoing square lobe.

Posterior Inferior Lobe – Corresponds in situation to the posterior or semilunar lobe.

CIRCUMFERENCE — Deeply notched in front & behind by the

Incisuræ Cerebelli Anterior & Posterior, – Of which the former embraces the tubercula quadrigemina & the superior peduncles, while the latter receives the falx cerebelli; – also divided into upper & lower lips by the

Great Horizontal Fissure – Which extends uninterruptedly from one middle peduncle to the other.

The other fissures are more or less parallel to the foregoing, and describe more or less concentric curves concave forwards & inwards; some fissures however are more or less oblique, and coalesce with the others so as not to extend over the whole breadth of the hemispheres. The largest fissures separate the lobes above described, the smaller ones demarcate the laminæ or folia, which latter cover the surface of the cerebellum and project also into the bottom of the larger fissures.

THE PEDUNCLES of the CEREBELLUM.

Superior, or Processus e Cerebello ad Testes – Arises in the laminæ of the inferior vermiform process and also in the interior of the corpus dentatum, passes upwards & inwards on either side of the middle line, being joined to its fellow by the valve of Vieussens, and ascends beneath the tubercula quadrigemina to the crura cerebri & optic thalami, partly decussating in the middle line.

Middle, Processus e Cerebello ad Pontem or Crus Cerebelli – The great transverse commissure of the cerebellum. Connects the laminæ of the lateral parts of one hemisphere to the corresponding laminæ of the opposite side, and forms the pons Varolii & the deep transverse fibres of the mesocephalon.

Inferior, or Processus e Cerebello ad Medullam – If traced from below upwards, it may be said to proceed from all three columns of the cord, *i.e.*, from the postero-external bundles of the anterior & middle columns, & from the fasciculus cuneatus or external bundle of the posterior column, the latter bundle being much the largest of the three. It ends in the laminæ of the middle part of the cerebellum, especially in those of the upper surface.

THE MEDULLA OBLONGATA.

The upper enlarged part of spinal cord.

Extends from lower border of Pons Varolii, above, to point of decussation of anterior pyramids below, which point corresponds pretty nearly to upper border of atlas.

Flattened from above downwards and forwards, and presents:

ANTERO-INFERIOR ASPECT – Rests upon basilar groove.

POSTERO-SUPERIOR ASPECT – Forms part superiorly of floor of 4th ventricle, and is continuous inferiorly with posterior surface of cord.

Divided, as is the cord, into two lateral halves, by

ANTERO-MEDIAN FISSURE – Continuous below with that of cord, being partly interrupted, however, by decussation of anterior pyramids. Terminates above, just below the pons, in a small recess, the foramen cœcum.

POSTERO-MEDIAN FISSURE – Continued above into ventricle of Arantius & postero-median fissure on floor of 4th ventricle, and below into postero-median fissure of cord.

SURFACE OF THE MEDULLA OBLONGATA.

Each half presents from before backwards between the two median fissures:

Anterior Pyramid – Pyramidal-shaped bundle of white fibres, the apparent prolongation of anterior column of cord; narrow below, enlarged and rounded off above, constricted just below the pons. Gives origin in its upper part to 6th cranial nerve.

Olivary Body – Oval prominent mass broader above than below, shorter than, but about as broad as, the pyramid. – It is separated from the pyramid by a narrow groove, which gives origin to 9th or hypo-glossal nerve, and from the lower part of which numerous arciform fibres are seen to proceed. These wind upwards and outwards round lower end of olivary body, sometimes crossing its surface. A few arciform fibres emerge from the anterior median fissure, and cross anterior aspect of pyramid (Sappey, Hirschfeld).

Lateral Tract – Is continuous with lateral column of cord. It is broad below, where it includes all that part of the medulla comprised between anterior pyramid and restiform body; above it is pushed backwards, and is narrowed, by the projection of the olivary body. It is separated from restiform body by a slight groove situated in a line with posterior lateral fissure of cord, and gives origin from above downwards to the facial, glosso-pharyngeal, pneumogastric & spinal accessory nerves.

Restiform Body or Fasciculus Cuneatus – Is the outer & larger, while the

Posterior Pyramid or Fasciculus Gracilis – Is the inner & smaller portion of a wide & thick bundle of white fibres continuous below with posterior column of cord, which bundle diverges from its fellow superiorly, and thus both exposes grey matter of floor of 4th ventricle and forms lower part of lateral boundary of that cavity. This wide & thick bundle used to be called, and is still sometimes called *the* restiform body. – From its inner edge there projects inwards a thin lamina of white matter termed the *ligula*, which may be considered as forming part of roof of 4th ventricle. Opposite apex of calamus scriptorius the posterior pyramid presents an enlargement, the *processus clavatus*. In front of the processus cuneatus, behind & a little below olivary body & in a line with postero-lateral fissure of cord, is a small greyish eminence, the *grey tubercle of Rolando*, which is formed by the projection of the substantia gelatinosa.

Grey Matter of Floor of 4th Ventricle – Vide 4th Ventricle.

THE FOURTH VENTRICLE.

Rhomboidal cavity bounded by the medulla oblongata & mesocephalon below & in front and the cerebellum above & behind, and closed in inferiorly by the layer of pia matter extending between these parts. Presents:

FLOOR — Lozenge-shaped, oblique downwards & backwards, covered by a stratum of grey matter from which arise the 6th, 7th, 8th, & 9th nerves * (Vide structure of medulla oblongata, 2nd Tablet); bounded on either side below by the posterior pyramids & restiform bodies, and above by the processus e cerebello ad testes. Presents the following parts, which give rise to the appearance termed the *calamus scriptorius*·

Postero-Median Fissure – Continued above into the aqueduct of Sylvius or iter a tertio ad quartum ventriculum, below into the ventricle of Arantius or short upper expanded part of the central canal and into the postero-median fissure of the cord.

Lineæ Transversæ – A few white fibres very variable in number sometimes scarcely recognisable, which emerge from the lower part of the postero-median fissure, cross the eminentiæ teretes, and join, some of them the crus cerebelli, others the roots of the auditory nerve; a few sometimes ascend to the locus cœruleus.

Eminentiæ Teretes – Two spindle-shaped elevations, greyish & slightly marked below, whiter & more prominent above, due to the fasciculi teretes, as they ascend beneath the grey matter on either side of the postero-median fissure. – On either side of these eminences is a

Groove, or rather, in well marked bodies, two small fossæ, which lie, the posterior, inferior & narrowest one, near the lower extremity of the ventricle, and the anterior, superior & broadest one, opposite the crus cerebelli. The latter fossa leads upwards to the

Locus Cœruleus – A bluish spot due to an accumulation beneath the surface, of dark vesicular matter termed the *substantia ferruginea*. From this spot the

Tinea Violacea, – A bluish streak, the continuation upwards of the locus cæruleus, ascends on the outer side of the eminentia teres to the opening of the aqueduct of Sylvius.

ROOF — Formed above by the superior peduncles of the cerebellum & the valve of Vieussens, below by the tonsils, the inferior vermiform process with the uvula, the nodule or laminated tubercle of Malacarne, & by the posterior medullary velum or commissura ad flocculum. Still lower down is the ligula.

LATERAL BOUNDARIES — Formed by the superior peduncles of the cerebellum above, and by the diverging restiform bodies & posterior pyramids below.

UPPER EXTREMITY — Presents the opening of the aqueduct of Sylvius or iter a tertio ad quartum ventriculum.

LOWER EXTREMITY — Usually presents an opening in the layer of pia mater which bounds the ventricle inferiorly, through which opening the ventricular cavities of the brain communicate with the subarachdoidean space of the brain & cord.

Choroid Plexuses of 4th Ventricle – Vide intra-cerebral portion of the pia mater.

THE MESOCEPHALON

Is the connecting link between the cerebrum, cerebellum & medulla oblongata. It consists of the following parts: –

Pons Varolii or *Tuber Annulare* with the superficial & deep transverse fibres of the *Middle Peduncles of the Cerebellum;*

Crura Cerebri divided into *under or fasciculated portion* and *upper part or tegmentum;*
Inferior Peduncles of the Cerebellum, and *Superior Peduncles* with the *Valve of Vieussens;*
Tubercula Quadrigemina & Pineal Gland.

Pons Varolii or Tuber Annulare – Broad transverse band of white fibres which arch like a bridge from one hemisphere of the cerebellum to the other, forming laterally the middle peduncles of the cerebellum. Presents: –

Under Surface – Marked by a median shallow groove for basilar artery. Gives off laterally the two roots, anterior small or motor, posterior large or sensory, of the 5th pair of cranial nerves.

Upper Border – The most prominent & the most convex, from beneath which the crura cerebri are seen to emerge.

Lower Border – Less prominent & less convex, into which the anterior pyramids, olivary fasciculi & lateral tracts of the medulla are seen to penetrate, and from the anterior aspect of which the 6th cranial nerves are sometimes given off. – Laterally the pons Varolii is continued into the two

Middle Peduncles of the Cerebellum or Crura Cerebelli – Which form its two lateral portions.

Crura Cerebri – Two thick cylindrical or slightly flattened bundles of white fibres about ¾ of an inch long & rather wider in front than behind, which emerge from the anterior border of the pons and pass forwards & outwards to the corpora striata & optic thalami. They are crossed externally by the 4th nerve & inferiorly by the optic tract, the anterior border of which latter is slightly adherent to them. Their inner border bounds posteriorly the interpeduncular space, and gives origin to the 3rd cranial nerve. They are divided into an under or fasciculated portion & an upper portion or tegmentum, between which two portions is a small mass of grey matter, the *locus niger.*

Inferior Peduncles of the Cerebellum or Processus e Cerebello ad Medullam – Two thick bundles of white fibres which descend from the inner & under part of the cerebellum to the back of the medulla, where they join the processus cuneati. They form the lower part of the lateral boundary of the 4th ventricle.

Superior Peduncles of the Cerebellum or Processus e Cerebello ad Testes – Two thick bundles of white fibres which ascend from the upper & inner part of the cerebellum to the testes, forming part of the roof & of the lateral boundary of the 4th ventricle. They are connected together by the

Valve of Vieussens – Thin transparent lamina of white matter narrow in front, where it presents a slight median ridge, the frenulum, and, on either side of this, the roots of the 4th nerve, broader behind, where it is continued into the under surface of the superior vermiform process and is crossed by a few transverse bands of grey matter prolonged upwards from the cerebellum. It forms the roof of the aqueduct of Sylvius & a part of the roof of the 4th ventricle.

Tubercula Quadrigemina – Four small rounded eminences separated by a crucial depression, and situated below the posterior extremity or splenium of the corpus callosum, above & behind the posterior commissure & the 3rd ventricle, above & in front of the superior peduncles of the cerebellum & the valve of Vieussens.

Anterior or Nates – Are larger, darker, slightly oblong from before backwards, and connected with the optic thalami & the commencement of the optic tracts by two broad white bands, the *brachia anteriora.*

Posterior or Testes – Are smaller, lighter in colour, more exactly rounded, and connected with the optic thalami & the commencement of the optic tracts by two narrower bands, the *brachia posteriora.*

Pineal Gland or Conarium – Small conical reddish-grey body situated between the nates, retained in position by a fold of pia mater derived from the under surface of the velum interpositum, and connected with the remainder of the cerebrum by means of a few transverse fibres belonging to the posterior commissure, and also by means of its

Peduncles – Two on each side:

Anterior or Superior – Run forwards over upper & inner part of optic thalami to anterior crura of fornix, with which they unite.

Posterior or Inferior – Descend vertically upon inner surface of optic thalami.

The pineal gland consists of grey matter with a few white fibres, and is very vascular. In its interior are one or two small cavities, which sometimes communicate with the 3rd ventricle, and which contain a transparent viscid fluid & a small amount of sabulous matter termed the *acervulus cerebri.*

THE SPINAL CORD

Extends from point of decussation of anterior pyramids (which point corresponds pretty nearly to the upper border of the atlas) to lower border of body of first lumbar vertebra, where it terminates in a slender filament, the filum terminale, which descends for a short distance into the ligamentum centrale.

Is from 15 to 18 inches long & slightly flattened from before backwards. Presents two enlargements, the cervical and the lumbar. The cervical, the larger, extends from the third cervical to the first dorsal vertebra, and is widest from side to side; the lumbar, the smaller, is situated opposite the last dorsal vertebra, and is widest from before backwards.

Presents fissures and columns.

FISSURES:

ANTERO-MEDIAN – Wider than the posterior, and penetrates to about one third of the thickness of the cord, its depth increasing slightly inferiorly. It contains a well-marked prolongation of the pia mater, and is bounded behind by the anterior or white commissure.

POSTERO-MEDIAN – Narrower than the anterior. It penetrates to the very centre of the cord, is most marked above and below, and contains but a very delicate process of pia mater. It is bounded in front by the posterior or grey commissure.

ANTERO-LATERAL (SO-CALLED) – Consist simply of a linear series of foramina corresponding to the points of emergence of the anterior roots of the spinal nerves.

POSTERO-LATERAL = Correspond to the line of attachment of the posterior roots, and lead down to the grey matter.

POSTERO-INTERMEDIARY (Hirschfeldt, Sappey) – Two delicate longitudinal furrows situated on either side of the postero-median fissure and most marked in the cervical region.

COLUMNS – Are demarcated by the fissures, and are termed

ANTERIOR, LATERAL, POSTERIOR AND POSTERO-MEDIAN – The two former being usually joined under the name of antero-lateral, and the postero-median being usually included in the posterior.

Gives off 31 pairs of nerves.

STRUCTURE of the SPINAL CORD—3rd Tablet.

Continuation Upwards of the White Fibres of the Columns into the Medulla Oblongata.

Anterior Column – Is thrust aside in the medulla oblongata by those antero-internal fibres of the lateral column, which, after decussating in the middle line, form the innermost & greater part of the anterior pyramid of the opposite side. It then divides into three bundles as follows:

INNERMOST BUNDLE – Joins externally the above mentioned antero-internal fibres of the lateral tract, and forms the smaller & outermost part of the anterior pyramid of the same side.

MIDDLE BUNDLE – Surrounds the olivary nucleus, above which it forms, with a few fibres arising from this nucleus, the olivary fasciculus or fillet.

EXTERNAL OR POSTERIOR BUNDLE – Passes upwards & backwards to join the processus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Lateral Column – Divides into three bundles as follows:

ANTERO-INTERNAL BUNDLE – Passes forwards & inwards between the anterior columns, thrusting these columns aside, and forms, after decussating in the middle line, the innermost & greater part of the anterior pyramid of the opposite side.

MIDDLE BUNDLE – Ascends with the fasciculus gracilis beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.

EXTERNAL OR POSTERIOR BUNDLE – Passes upwards & backwards to join the fasciculus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Posterior Column – Divides into two bundles as follows:

INTERNAL BUNDLE OR FASCICULUS GRACILIS – The smaller. Ascends beneath the grey matter of the floor of the 4th ventricle, and goes to form part of the fasciculus teres.

EXTERNAL BUNDLE OR FASCICULUS CUNEATUS – The larger. Diverges from its fellow at the apex of the calamus scriptorius, and passes upwards & outwards to form the greater part of the inferior peduncle of the cerebellum.

N.—The reader is here reminded once for all that by the "continuation" of nerve-fibres referred to in this & other Tablets, the Author means, not the continuation of the individual tubular fibres (respecting the absolute origin & termination of which tubular fibres little is yet positively known), but the continuation of the several *bundles* of nerve-fibres, which continuation is marked by the general direction of the fibres.

STRUCTURE of the MEDULLA OBLONGATA—1st Tablet.

Presents for examination longitudinal, antero-posterior & transverse fibres, and grey matter.

LONGITUDINAL FIBRES — Form five bundles continuous on the one hand with the columns of the cord, and on the other with the longitudinal fibres of the mesocephalon, *i.e.*, three large ones, *anterior pyramid, lateral tract & fasciculus cuneatus*, and two smaller ones, *olivary fasciculus or fillet, & posterior pyramid or fasciculus gracilis.*

Their mode of Continuation with the Columns of the Cord – Is as follows: –

Anterior Pyramid – With antero-internal bundle of lateral column of opposite side, and with innermost bundle of anterior column of same side. The former bundle forms the innermost decussating & by far greater portion of the anterior pyramid; the latter bundle forms that small outer portion of the ant. pyramid, the fibres of which do not decussate in the middle line.

Lateral Tract – With lateral column of same side.

Fasciculus Cuneatus – With external & greater part of posterior column, and with external or posterior bundles of anterior & lateral columns all of same side.

Olivary Fasciculus or Fillet – Partly with middle bundle of anterior column of same side; its other fibres are derived from the olivary nucleus.

Posterior Pyramid or Fasciculus Gracilis – With posterior column of same side.

Their mode of Continuation with the Longitudinal Fibres of the Meso-cephalon – Is as follows: –

Anterior Pyramid – Ascends through the mesocephalon to the inferior or fasciculated portion of the crus cerebri, from whence its fibres are prolonged to the corpora striata.

N.—The cerebellar fibres & the fibres to the olivary body, which are said in some of our best standard works on Anatomy to be derived from the anterior pyramid, are derived not from the anterior pyramid itself, that is to say not from the pyramidal-shaped bundle, which, in the *surface description* of the cord, is called the "anterior pyramid," but from the middle & external bundles of the *anterior column of the cord.* (Vide continuation upwards of the white fibres of the columns of the cord into the medulla oblongata).

Lateral Tract – Divides into three bundles as follows (or rather it is the *anterior column of the cord* which thus divides, for the division here referred to takes place a little below the point of decussation of the pyramids, that is to say below the point which is usually taken as the boundary between the medulla & the cord): –

Antero-internal Bundle – Passes upwards & inwards, decussating with its fellow, and forms the innermost & greater part of the anterior pyramid of the opposite side.

Middle Bundle – Ascends with the fasciculus gracilis beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.

External or Posterior Bundle – Passes upwards & backwards to join the fasciculus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Fasciculus Cuneatus – Passes up to the cerebellum with the external or posterior bundles of the anterior & lateral columns of the cord, forming with them the inf. peduncle of the cerebellum.

Olivary Fasciculus or Fillet – Divides into two bundles as follows: –

Antero-internal Bundle – Ascends through the mesocephalon with the middle bundle of fibres of the lateral tract, and joins the upper part or tegmentum of the crus cerebri.

Postero-external Bundle – Passes upwards & outwards through the mesocephalon, issues from the transverse fibres of the pons externally to the crus cerebri, and finally ascends over the superior peduncle of the cerebellum to the tubercula quadrigemina, decussating with its fellow above the aqueduct of Sylvius.

Posterior Pyramid or Fasciculus Gracilis – Ascends with the middle bundle of the lateral column beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.

ANTERO-POSTERIOR FIBRES — Form a median septum most marked at the upper part of the medulla. They partly decussate with each other (Clarke). Some emerge from the antero-median fissure, or pass between the anterior pyramid & the olivary body and emerge below the roots of the 9th nerve; these two sets form the arciform fibres mentioned in the surface description of the medulla. Others emerge from the postero-median fissure, and form the lineæ transversæ of the floor of the 4th ventricle.

TRANSVERSE FIBRES — The arciform fibres form a superficial set. A deep set join the olivary nuclei & the nuclei contained in the posterior pyramids & processus cuneati.

GREY MATTER —

ARTERIES of the BASE of the BRAIN.

Are the anterior & middle cerebral branches of the internal carotid and the posterior cerebral of the basilar, which are joined together by the anterior & posterior communicating.

Anterior Cerebral – Anterior & smaller of the branches of bifurcation of internal carotid opposite inner extremity of fissure of Sylvius.

Forwards & inwards towards longitudinal fissure, being connected with each other by Anterior Communicating, – A small branch about two lines in length.

Round genu and along upper surface of corpus callosum, and join with posterior cerebral. Give off small branches to anterior perforated space and to inner & under surfaces of frontal lobe.

Middle Cerebral –The larger of the two terminal branches of internal carotid.

Forwards & outwards along fissure of Sylvius, giving twigs to anterior perforated space, and divides into branches to pia mater of frontal, parietal & temporo-sphenoidal lobes, and to central lobe or Island of Reil. – Sometimes gives off anterior choroid.

Posterior Communicating – Very variable in size.

From back part of internal carotid just before its bifurcation.

Backwards parallel to its fellow, and inosculates with posterior cerebral.

Posterior Cerebral – Two; terminal branches of basilar.

Forwards and outwards for a short distance giving numerous branches to posterior perforated space, and join posterior communicating.

Backwards & outwards on crura cerebri in front of 3rd nerve, and, curving slightly inwards, divide into numerous branches to inner, under, & outer surfaces of occipital lobe.

CIRCLE OF WILLIS — Is formed in front, laterally & behind respectively by:

Anterior cerebral arteries joined by the *anterior communicating*,

Trunks of internal carotids & posterior communicating,

Posterior cerebral & basilar.

Within the circle of Willis are comprised from before backwards the lamina cinerea, optic commissure, tuber cinereum with the infundibulum, corpora albicantia & posterior perforated space.

APPENDIX.

CARPUS & TARSUS.

How to Distinguish Bones of the Carpus into Right & Left.

It is easy to recognise whether a bone of the carpus belongs to the right or to the left side when it is placed in position as follows:

Scaphoid – Largest articular facet above;
Rough transverse groove behind;
Tubercle on outer side.

Semilunar – Convex articular facet above;
Largest rough surface in front;
Semilunar articular facet on outer side.

Cuneiform – Convex surface partly articular & partly non-articular, above;
Flat surface partly articular partly non-articular in front;
Small surface or angle on inner side.

Pisiform – Articular facet behind;
Non-articular part of same surface below,
Concave surface on inner side.

Trapezium – Saddle-shaped articular facet below;
Ridge in front;
Rough lateral surface on outer side.

Trapezoid – Saddle-shaped articular facet below;
Large rough surface behind;
Its projecting part on inner side.

Os Magnum – Head above;
Large rough surface behind;
Projecting part of the same (or tubercle of the base) on inner side.

Os Unciform – Unciform process below & in front;
Its concavity to outer side.

BONES of TARSUS—1st Row.

THE ASTRAGALUS

Supports the tibia, rests upon the os calcis, articulates on either side with the malleoli & in front with scaphoid. Is irregularly cuboid, and presents six surfaces.

Upper Surface – Presents:

TROCHLEAR SURFACE – Broadest in front, convex from before backwards, slightly concave from side to side; in front of which surface is the

Upper Surface of the Neck – Rough for ligaments.

Under Surface – Presents:

Deep Groove – Directed forwards & outwards and broadest in front, for interosseous calcaneo-astragaloid ligament; this groove separates

TWO ARTICULAR FACETS – For os calcis; the posterior one, the largest, is concave; the anterior one, the smallest, is convex, continuous with the anterior articular surface and sometimes divided into two parts, one for lesser process of os calcis, one for calcaneo-scaphoid ligament.

Inner Surface – Presents:

TRIANGULAR ARTICULAR FACET – Small, continuous with trochlear surface, for internal malleolus; below this facet is a

Rough Groove – For deep portion of internal lateral ligament of ankle-joint.

Outer Surface – Presents:

TRIANGULAR ARTICULAR FACET – Much larger, concave from above downwards, also continuous with trochlear surface; in front of which is a

Deep Depression – For anterior fasciculus of external lateral ligament of ankle-joint.

Anterior Surface – Forms the

HEAD – Oval, oblique downwards & inwards, & convex for scaphoid, continuous inferiorly with anterior facet of under surface, and supported by a constricted part, the

NECK.

Posterior Surface – Very narrow, and represented merely by a slight

Groove – Oblique downwards & inwards for tendon of flexor longus pollicis.

THE OS CALCIS

Irregularly cuboid; presents six surfaces.

Upper Surface – Presents from before backwards:

Upper Surface of Greater Process – Presenting a rough depresssion for extensor brevis digitorum;

TWO ARTICULAR SURFACES – For astragalus, and an intervening *deep groove* oblique forwards & outwards, and broadest in front for interosseous calcaneo-astragaloid ligament. – The posterior & external facet is convex, the largest, and situated on the body of the bone. The anterior or internal facet is concave, the smallest, and situated on the lesser process; it is sometimes divided into two.

Rough Saddle-shaped Surface – Belonging to the portion of the bone which projects backwards to form the heel.

Under Surface – Rough, convex from side to side, widest behind. Presents from behind forwards:

Two Tubercles – The internal, the largest, for abductor pollicis & flexor brevis digitorum; the external, the smallest, for abductor minimi digiti.

Rough Surface – For outer head of flexor access. & long calcaneo-cuboid ligt.

Tubercle & Transverse Groove – For short calcaneo-cuboid ligament.

Inner Surface – Concave for passage of vessels, nerves, & flexor tendons. Gives attachment to inner head of flexor accessorius, and is surmounted by the

LESSER PROCESS, OR SUSTENTACULUM TALI – Which articulates above with the astragalus, is grooved inferiorly for tendon of flexor longus pollicis, and gives attachment by its inner margin to a part of the superficial fibres of the internal lateral ligament of the ankle-joint.

Outer Surface – Presents towards its middle a

Tubercle – For middle fasciclus of external lateral ligament of ankle-joint; and in front of the tubercle,

Two Grooves – Separated by a slight ridge for tendons of peronei.

Anterior Surface – Concavo-convex for articulation with cuboid; is surmounted externally by a rough prominent tubercle which is an important guide in Chopart's amputation.

Posterior Surface – Rough & broad below for insertion of tendo Achillis & plantaris muscle, narrow & smooth above, where it is covered by a bursa.

BONES of TARSUS—2nd Row.

THE SCAPHOID — Presents:

ANTERIOR SURFACE – Convex, broadest externally; presents *three triangular facets* for the cuneiform.

POSTERIOR SURFACE – Concave, for head of astragalus, also broadest externally.

CIRCUMFERENCE – Rough, convex above, concave below. Presents below & internally a *tubercle*, for tendon of tibialis porticus; and sometimes externally a *facet*, for cuboid.

THE CUBOID — Presents:

Articular Surfaces – Three:

ANTERIOR – Presents two facets, *inner*, smaller, quadrilateral for 4th metatarsal, *outer*, larger, triangular for 5th metatarsal.

POSTERIOR – Quadrilateral, concavo-convex for os calcis.

INTERNAL – Presents towards middle & upper part a *large anterior facet* for external cuneiform; and sometimes behind this a *smaller posterior facet* for scaphoid. – The remainder of this surface is rough for ligaments.

Non-Articular Surfaces – Three:

SUPERIOR – Rough, oblique downwards & outwards.

INFERIOR – Presents from before backwards: *deep groove* oblique forwards & inwards, which transmits tendon of peroneus longus, and is bounded behind by a prominent *ridge* for long calcaneo-cuboid ligament, which ridge begins externally in a prominent *tubercle* presenting a small facet for a sesamoid bone; *rough surface* for short calcaneo-cuboid ligament, and part of the flexor brevis pollicis.

OUTER – A mere border notched by commencement of peroneal groove.

THE CUNEIFORM BONES

Three, wedge-shaped, & six sided. All three present

COMMON CHARACTERS:

DORSAL SURF. – Quadrilateral, and rough for ligaments. Looks obliquely inwards in the internal cuneiform, in which bone it also presents a small groove or facet for tendon of tibialis anticus.

PLANTAR SURF. – Rough rounded border in the two outermost. In the innermost it is a broad rough surface marked behind by a tubercle for the tibialis posticus.

POSTERIOR SURF. – Triangular & concave from above downwards. They articulate with the three facets on anterior surface of scaphoid, and lie in the same transverse line.

ANTERIOR SURF. – Triangular in the two outermost, kidney-shaped in the innermost; they articulate with the bases of the three innermost metatarsal bones. These surfaces present an indented outline; the middle cuneiform being shorter than the two others, its anterior surface is depressed.

LATERAL SURF. – Articulate with each other, the cuboid, both sides of the base of the 2nd metatarsal bone & the inner side of the base of the 4th; the lateral surfaces of the 3rd cuneiform presenting each of them two facets, and the adjoining surfaces of the 1st & 2nd presenting a facet angular in shape & running along the superior & posterior borders. The inner surface of the internal cuneiform is a mere rounded border.

DISTINCTIVE CHARACTERS

BETWEEN THE THREE BONES.

FIRST – Larg size, irregular form, anterior kidney-shaped surface, facet for tibialis anticus, tubercle for tibialis posticus.

SECOND – Small size, square-shape of dorsal surface, angular articular facet along the upper & back part of its inner surface.

THIRD – Intermediate size, two facets on both of its lateral surfaces.

BETWEEN THE BONES OF THE TWO SIDES — Are evident in the case of the first & second cuneiform. To have the three points necessary to place the third one in position all that is requisite is to remark that the ant. internal facet is rather larger than the ant. external.

METATARSAL BONES (Distinctive Characters).

FIRST METATARSAL BONE — The shortest & much the thickest.

SHAFT – Very thick & strong.

TARSAL EXTREMITY – Presents a large semilunar facet for internal cuneiform, but has no lateral articular facets. It is prolonged below & externally into a prominent tubercle for tendon of peroneus longus.

DIGITAL EXTREMITY – Large & broad. Presents inferiorly two grooved facets for sesamoid bs.

SECOND METATARSAL BONE — The longest; received posteriorly into the recess between the three cuneiform bones.

TARSAL EXTREMITY – Presents:

Tarsal Facet – Triangular, for middle cuneiform.

Lateral Facets – Three: – One internal for internal cuneiform; two external for external cuneiform & 3rd metatarsal. These two latter facets are often divided into upper & lower halves by a rough horizontal groove for an interosseous ligt.

THIRD METATARSAL BONE — A little shorter.

TARSAL EXTREMITY – Presents:

Tarsal Facet – Triangular, for external cuneiform.

Lateral Facets – Two: – One internal & one external for 2nd & 3rd metatarsal bs.; the former facet is often divided into upper & lower halves by an interosseous groove.

FOURTH METATARSAL BONE —

TARSAL EXTREMITY – Presents:

Tarsal Facet – Quadrilateral, for cuboid.

Lateral Facets – Three: – One ext. for 5th metatarsal, two int. for 3rd metatarsal & external cuneiform; the facet for the external cuneiform being sometimes absent.

FIFTH METATARSAL BONE — The shortest but one.

TARSAL EXTREMITY – Presents:

Tarsal Facet – Triangular, cut obliquely forwards & inwards, for cuboid;

Internal Lateral Facet – For 4th metatarsal;

Prominent External Tubercle – For peroneus brevis.

N.B. — The foregoing characters supply the three points requisite to place the bones in position, and therefore to distinguish between right bones and left bones

METACARPAL BONES (Distinctive Characters).

METACARPAL B. OF THUMB — The shortest.

SHAFT – Thick & broad; its palmar surface looks inwards.

CARPAL EXTREMITY – Saddle-shaped for trapezium (convex from before backwards, concave from side to side) & broadest externally; no lateral facets.

DIGITAL EXTREMITY – Broader & less convex anteriorly than in the other metacarpal bones; presents two small lateral facets for sesamoid bones.

METACARPAL B. OF INDEX — The longest.

CARPAL EXTREMITY – Larger than in the others, and presents posteriorly a prolongation upwards & inwards towards os magnum. Has four articular surfaces, one saddle-shaped above for trapezoid, and three others for trapezium, os magnum & 3rd metacarpal bone.

METACARPAL B. OF MIDDLE FINGER — The longest but one.

CARPAL EXTREMITY – Presents a prolongation upwards & outwards behind os magnum, and has four articular facets, one for os magnum, one for 2nd metacarpal bone, and two for 4th.

METACARPAL B. OF RING FINGER — Short.

CARPAL EXTREMITY – Pretty regularly cuboid. Presents five facets for unciform, os magnum, 3rd (two facets), & 5th metacarpal bones.

METACARPAL B. OF LITTLE FINGER — The smallest & the shortest but one.

CARPAL EXTREMITY – Has a prominent tubercle on inner side for extensor carpi ulnaris; carpal facet is saddle-shaped for unciform; only one lateral facet for 4th metacarpal bone.

N.B.—The foregoing characters supply the three points requisite to place the bones in position, and therefore to distinguish between right bones and left bones.

SINUSES of the DURA MATER.

Venous canals fifteen in number, and more or less triangular in shape, the outer coat of which is formed by the splitting of the dura mater, while their inner coat is a continuation of the inner or serous coat of the veins. They are divided into:

POSTERO-SUPERIOR GROUP: – *Superior Longitudinal, Inferior Longitudinal, Straight, Lateral, & Occipital,* all converging towards the *Torcular Herophili.*

ANTERO-INFERIOR GROUP: – *Cavernous, Circular, Transverse, Superior & Inferior Petrosal,* all converging towards the sella turcica.

Superior Longitudinal Sinus – Commences at foramen cœcum, through which it frequently communicates by a minute branch with veins of Schneiderian membrane of nose. Runs backwards in attached margin of falx cerebri, grooving middle line of frontal, adjacent borders of parietals & superior division of crucial ridge of occipital, and opens into torcular Herophili. Numerous fibrous bands the *chordæ Willisii,* cross inferior angle of its cavity, and the *glandulæ* Pacchionii project into its base. It receives the superficial veins of upper part of hemispheres, numerous veins from diploë & dura mater, and, at posterior extremity of sagittal suture, the parietal veins from the pericranium.

Inferior Longitudinal Sinus – Sometimes called a vein on account of its cylindrical form. Follows posterior part of free margin of falx cerebri, and opens into anterior extremity of straight sinus behind the venæ Galeni. It receives several small veins from the falx, and occasionally a few from inner surface of hemispheres.

Straight Sinus – Runs downwards & backwards in line of junction of falx cerebri with tentorium cerebelli, and opens into torcular Herophili. Receives venæ Galeni, inferior longitudinal sinus, inferior median cerebral, & superior cerebellar veins. A few fibrous bands cross its superior angle.

Occipital Sinuses – Usually two, small, contained in attached margin of falx cerebelli. Arise near posterior border of foramen magnum in several small veins which communicate with posterior longitudinal spinal veins. They pass backwards & upwards, and open separately or together into torcular Herophili.

Lateral Sinuses – Two, large. Commence at torcular Herophili; pass outwards in posterior attached margin of tentorium cerebelli as far as base of petrous portion of temporal bone, grooving occipital & posterior inferior angles of parietals; curve downwards & inwards grooving mastoid portion of temporals and again the occipital at its lateral angles; and are continued into the internal jugular vein through posterior outer or larger part of foramen lacerum posterius. – They receive the inferior cerebral & inferior cerebellar veins & some veins from the diploë, they are connected to the cavernous sinus by the superior & inferior petrosal sinuses, and they communicate through the mastoid foramen with the mastoid & posterior condyloid veins of the pericranium. The right one is generally somewhat the larger of the two.

Torcular Herophili – An irregular expansion of the postero-superior group of sinuses pretty nearly corresponding in situation to the external occipital protuberance, and formed by the coalescence of the superior longitudinal, straight & occipital sinuses, which pour their blood into it, and of the lateral sinuses, which convey the blood from the torcular to the internal jugular veins.

Cavernous Sinuses – Two large but short sinuses, extending on either side of sella turcica from sphenoidal fissure to apex of petrous portion of temporal bone, and communicating with each other through circular & transverse sinuses, and with the lateral sinuses through the superior & inferior petrosal. Their cavity is intersected by numerous fibrous bands & small vessels; hence their name. Against their inner wall, separated from the blood by the lining membrane of the sinus, are the cavernous portion of the internal carotid artery, the 6th nerve, & the carotid & cavernous plexuses of the sympathetic; in their outer wall lie from above downwards & from within outwards the 3rd, 4th, & ophthalmic nerves. They receive the ophthalmic & anterior inferior cerebral veins.

Circular Sinus – Placed superficially in ring of dura mater which surrounds pituitary body. Receives small veins from this body, adjacent bone, & dura mater, and communicates on either side with the cavernous sinus. Its posterior half is generally larger than the anterior.

Transverse Sinus – Small & short. Crosses fore part of basilar groove, connecting cavernous & inferior petrosal sinuses of one side to those of the other; is sometimes double.

Superior Petrosal Sinus – Small, along upper border of petrous portion of temporal bone in anterior attached margin of tentorium, connecting lateral & cavernous sinuses of same side. Receives inferior cerebellar & inferior lateral cerebral veins.

Inferior Petrosal Sinus – Somewhat larger than foregoing. Along groove in petro-occipital suture, connecting cavernous sinus to termination of the lateral in jugular foramen.

TABLEAU of the CRANIAL NERVES.

First or Olfactory – Arises by three roots:
Ext. or Long Root – From *posterior border of fissure of Sylvius.*
Int. or Short Root – From *posterior & inner part of frontal lobe.*
Middle or Grey Root – From *caruncula mammillaris.* – Presents olfactory process, olfactory bulb, terminal branches.

Second or Optic – From *anterior & posterior quadrigeminal* and *internal & external geniculate bodies,* and *optic thalamus.* – Presents optic tract, optic commissure or chiasma, & optic nerve proper.

Third or Motor Oculi – From *inner border of crus cerebri* just in front of Pons Varolii. – Supplies all the muscles of the orbit except superior oblique & external rectus, and gives off motor root to lenticular ganglion.

Fourth, Trochlearis or Patheticus – From *upper part of valve of Vieussens.* – Supplies superior oblique.

Fifth, Trigeminal or Trifacial – Vide next Tableau.

Sixth or Abducens – From *constricted part of corpus pyramidale* close to pons Varolii or from *lower border of pons itself.* – Supplies external rectus.

Facial or Portio dura of the 7th – From *upper part of lateral tract of medulla oblongata* in groove between olivary & restiform bodies.
ANASTOMOSES – With *auditory, glosso-pharyngeal, pneumogastric, auriculo-temporal, great auricular;* – also large, small, & external petrosal nerves join *Meckel's & Arnold's ganglia & sympathetic.*
BRANCHES – *Large, small, & external petrosal, tympanic, chorda tympani, posterior auricular, muscular* (to stylo-hyoid & posterior belly of digastric), *temporo- & cervico-facial.*

Auditory or Portio Mollis of the 7th – From *floor of 4th ventricle,* its fibres of origin forming the *lineæ transversæ,* and also from the restiform body & perhaps from pons Varolii. – Divides into *vestibular & cochlear nerves.*

Glosso-pharyngeal – From *lateral tract of medulla oblongata above pneumogastric.* Presents two ganglia in anterior or inner part of jugular foramen, the superior or jugular, and the inferior or petrous.
ANASTOMOSES – With *pneumogastric & facial,* and through Jacobson's nerve with *carotid plexus and great & small petrosal nerves.*
BRANCHES – *Tympanic, carotid, pharyngeal, muscular* (to stylo-pharyngeus & constrictors), *tonsillar, lingual.*

Pneumogastric – *From lateral tract of medulla oblongata below glosso-pharyngeal & above spinal accessory.* – Presents two ganglia,– superior or jugular, small, rounded, situated in jugular foramen,– inferior or petrosal, large, cylindrical, situated below the foramen.
ANASTOMOSES – With *facial, the two other branches of the 8th, hypoglossal, sympathetic, loop between the two first cervical nerves.*
BRANCHES – *Auricular, pharyngeal, superior laryngeal, inferior or recurrent laryngeal, cardiac, pulmonary, œsophageal & gastric.*

Spinal Accessory –
ACCESSORY PORTION – From *lateral tract of medulla oblongata below pneumogastric.* Joins pneumogastric, and assists in forming the *pharyngeal, superior & inferior laryngeal branches* of the latter.
SPINAL PORTION – *From lateral column of the cord as low as 5th or 6th cervical nerves.* – Enters skull through foramen magnum, leaves it through jugular foramen in same sheath as pneumogastric, and supplies under surface of trapezius

Hypoglossal – From *groove between anterior pyramid & olivary body* by ten or twelve filaments, which form two bundles. Leaves skull through anterior condyloid foramen.
ANASTOMOSES – With *pneumogastric, sympathetic, two first cervical nerves & gustatory.*
BRANCHES – *Descendens noni, muscular* (to thyro- & genio-hyoid), *lingual* (to stylo-glossus, hyo-glossus, genio-hyo-glossus & substance of the tongue).

TABLEAU of the FIFTH NERVE.

From *side of pons Varolii* by two roots, *anterior small or motor, posterior large or sensory.*

Sensory root to Gasserian Ganglion, motor root to inferior maxillary nerve outside cranium.

Gasserian Ganglion gives off:

OPHTHALMIC — The smallest. Through outer wall of cavernous sinus below & externally to the other nerves, and divides into:

LACHRYMAL – The smallest of the three divisions of ophthalmic.

FRONTAL – The largest.

NASAL – Intermediate in size. Gives off branches: *ganglionic, long ciliary, infratrochlear.*

Ophthalmic, Ciliary or Lenticular Ganglion.

THREE ROOTS – *Sensory*, from *nasal branch of ophthalmic.*
Motor, from *branch of 3rd nerve to inferior oblique.*
Sympathetic, from *cavernous plexus.*

BRANCHES – The *ciliary nerves.*

SUPERIOR MAXILARY — Intermediate in size between ophthalmic & inferior maxillary. Through foramen rotundum, spheno-maxillary fossa, & infraorbital canal to infraorbital foramen, where divides into *palpebral, nasal, labial.* Gives off branches: *orbital or temporo-malar, spheno-palatine, posterior & anterior dental.*

Spheno-palatine or Meckel's Ganglion.

THREE ROOTS – *Sensory*, from *superior maxillary.*
Motor, from *facial* through vidian.
Sympathetic, from *carotid plexus* also through vidian.

BRANCHES:
Ascending – Small filaments to periosteum of orbit.
Descending – Anterior or great palatine, external palatine, posterior or small palatine.
Internal – Superior nasal, naso-palatine.
Posterior – Vidian, pterygo-palatine.

INFERIOR MAXILLARY — The largest, both sensory & motor. Divides just below base of skull into:

ANTERIOR OR SMALLER DIVISION – Principally motor. Divides into branches: *masseteric, two deep temporal, buccal, two pterygoid.*

POSTERIOR OR LARGER DIVISION – Sensory with a few motor fibres. Divides into *auriculo-temporal, gustatory, inferior dental*, the latter giving off the mylo-hyoid branch.

Otic or Arnold's Ganglion.

THREE ROOTS – *Sensory*, from *auriculo-temporal*, and also from *glosso-pharyngeal* through small petrosal.
Motor, from *inferior maxillary* & its *internal pterygoid branch*, also from *facial* through small petrosal.
Sympathetic, from plexus on middle meningeal artery.

BRANCHES – To *tensor palati & tensor tympani.*

Submaxillary Ganglion.

THREE ROOTS – *Sensory*, from *gustatory.*
Motor, from *facial* through chorda tympani.
Sympathetic, from plexus on facial artery.

BRANCHES – To mucous membrane of mouth, Wharton's duct, & submaxillary gland.

THE ABDOMINAL APONEUROSES.

Are the *anterior abdominal aponeurosis, or abdominal aponeurosis proper*, which is strengthened posteriorly by the fascia transversalis, and the *lumbar fascia*.

ANTERIOR ABDOMINAL APONEUROSIS — Is formed by aponeuroses of external & internal oblique, and by anterior aponeurosis of transversalis, which aponeuroses may be considered as expanded tendons of insertion. They all three assist in forming the linea alba & the sheath of the rectus.

APONEUROSIS OF EXTERNAL OBLIQUE — The strongest & widest of the three, and widest at its lower part; blended with aponeurosis of internal oblique in front of rectus and for some distance on either side, especially at upper part. Its fibres are oblique downwards & forwards, and form in succession *Poupart's ligament, Gimbernat's ligament, Outer or inferior pillar of external abdominal ring, Inner or Superior pillar, Superficial part of linea alba* by decussating with their fellows, and perhaps also after decussating, the *Triangular ligament* & *the Intercolumnar fibres of the opposite side.*

Poupart's Ligament - Strong curved band extending from anterior superior spine of ilium to spine of pubes, convex downwards & outwards, blended inferiorly with iliac fascia, internally with outer pillar of external abdominal ring, posteriorly with deep crural arch.

Gimbernat's Ligament - Small triangular process reflected downwards, outwards & backwards from inner part of Poupart's ligament to ilio-pectineal line, and of which the outer concave margin forms inner boundary of femoral ring.

Outer or Inferior Pillar of External Abdominal Ring - Blended with Poupart's ligament and attached with it to spine of pubes. Curves round inferior aspect of spermatic cord so as to form a groove upon which the cord rests.

Inner or Superior Pillar of External Abdominal Ring - Broad, thin; interlaces with its fellow in front of symphysis.

Linea Alba - Vide Below.

Triangular Ligament - A triangular band lying behind inner pillar of external abdominal ring & Gimbernat's ligament and in front of conjoined tendon, and extending from lower part of linea alba to ilio-pectineal line. It is formed according to some anatomists by prolongation across median line of lowest of those fibres of aponeurosis of external oblique of oppsite side which enter into formation of linea alba.

Intercolumnar Fibres - Are interwoven at right angles with, and bind together, the fibres of aponeurosis of external oblique, and more particularly those fibres which form the pillars of external abdominal ring. They extend downwards and outwards from middle & lower parts of linea alba to middle of Poupart's ligament describing curves convex inferiorly, and are said to be the continuation beyond the linea alba of middle fibres of aponeurosis of external oblique of opposite side. - Continuous with this layer of fibres is the *intercolumnar or external spermatic fascia*, thin closely adherent to margins of external abdominal ring, and prolonged downwards into a tubular process around cord & testis.

APONEUROSIS OF INTERNAL OBLIQUE — Thinner & rather narrower than foregoing, and narrowest at lower part. Divides opposite upper three-fourths of rectus into two layers, which blend, the one with aponeurosis of external oblique, the other with that of transversalis, and which pass, the one in front of, the other behind rectus, and again unite at linea alba. Passes wholly in front of lower part of rectus.

ANTERIOR APONEUROSIS OF TRANSVERSALIS — The narrowest of the three, especially above, where some muscular fibres extend a little behind rectus. Passes behind rectus in its upper three-fourths, blending with posterior layer of aponeurosis of internal oblique. Passes in front of rectus in its lower fourth, blending with aponeurosis of external & internal oblique.

SHEATH OF RECTUS — Is therefore complete in front and incomplete behind, where it corresponds only to upper three-fourths of the muscle; the deficiency in posterior wall of sheath being marked superiorly by the *Fold of Douglas*, a well defined fibrous band concave inferiorly. In front it is formed by all three aponeuroses below, but only by aponeurosis of external oblique & anterior layer of aponeurosis of internal oblique, above. Behind, it is formed, where it exists, by aponeurosis of transversalis & posterior layer of aponeurosis of internal oblique.

LINEA ALBA — Tendinous *raphé* from ensiform cartilage to pubes, bounded by inner borders of recti; narrow below & broad above; perforated by numerous vascular & nervous foramina, and by umbilicus, opposite which it is closely adherent to integument.

LINEÆ SEMILUNARES — Two curved depressed linear spaces produced on either side of recti, by absence of muscular fibres between these muscles and inner margin of muscular portion of internal oblique & transversalis.

POSTERIOR ABDOMINAL APONEUROSIS OR LUMBAR FASCIA — Formed by posterior aponeurosis of transversalis, the posterior layer of which aponeurosis is blended with vertebral aponeurosis and with aponeuroses of latissimus dorsi & serratus posticus inferior.

POSTERIOR OR VERTEBRAL APONEUROSIS OF TRANSVERSALIS — Divided into three layers.

Posterior or Superficial Layer - The strongest. Attached to *apices of spinous processes* of lumbar & sacral vertebræ, and blends with aponeuroses above mentioned. Gives origin to middle fibres of internal oblique, and binds down erector spinæ.

Middle Layer - Of considerable strength. Separates erector spinæ from quadratus lumborum, and becomes attached to *apices of transverse processes* of lumbar vertebræ.

Anterior Layer - The thinnest. Covers anterior aspect of quadratus lumborum, forming superiorly the ligamentum arcuatum externum, and becomes attached to *bases of transverse processes.*

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

PERINÆAL NERVE — The larger. Accompanies superficial perinæal artery, and divides into branches: -

Cutaneous or Superficial Perinæal - Two in number:

Posterior or Internal - Gives filaments to skin in front of anus (and to the sphincter ani, Gray), and communicates with the inferior hæmorrhoidal nerve. It then passes forwards to the scrotum or labium on the inner side of the following nerve with which it communicates anteriorly.

Anterior or External - Forwards on outer side of foregoing to scrotum & integument of penis, or labium. Communicates with foregoing, and with inferior pudendal, and gives a few twigs to levator ani.

Muscular - Generally arise by a common trunk, which passes forwards and inwards under cover of transversus perinæi, and supplies anterior extremity of sphincter ani, transversus perinæi, erector penis, accelerator urinæ & compressor urethræ; a twig is given to the bulb of the urethra.

DORSAL NERVE OF THE PENIS — The smaller. With pudic artery along rami of ischium & pubes between the two layers of deep perinæal fascia, and through suspensory ligament and along dorsum of penis to glans. Supplies skin of dorsum & sides of penis, and gives a large branch to corpus cavernosum. - *Dorsal nerve of clitoris* in female is smaller, but similarly distributed

Inferior Hæmorrhoidal Nerve - May be derived directly from sacral plexus. Crosses ischio-rectal fossa towards lower end of rectum, and gives off numerous branches to sphincter ani & integument round anus; communicates with superficial perinæal & inferior pudendal.

INFERIOR THYROID ARTERY.

(*Vide page* 159.)

Tortuous course upwards & inwards behind common carotid artery & sympathetic nerve, (the middle cervical ganglion, when present, resting upon it) to under surface of thyroid gland, and anastomoses with the other thyroid arteries. - Gives off branches:

Ascending Cervical - Ascends between scalenus anticus & rectus capitis anticus major; gives branches to deep muscles of neck, and, through the intervertebral foramina, to spinal cord & its membranes and bodies of the vertebræ.

Laryngeal - Upon trachea to back of larynx; supplies muscles & mucous membrane.

Tracheal - Join below with bronchial.

Œsophageal - Descend upon œsophagus.

THE CLASSIFICATION of JOINTS.

The joints may be divided into:

SYNARTHROSES — The bones are immoveably interlocked, and are in almost immediate contact, being separated only by a thin layer of periosteum termed the sutural ligament, and, at the base of the skull, by a thin layer of cartilage. – The varieties are the:

Sutura Vera – The bones present a series of processes & indentations, which fit in with each other. The subvarieties are the:

S. Dentata – The interlocking processes are large & ramified. – Ex.: *Sagittal & lamboid sutures.*

S. Serrata – The interlocking processes are smaller & more regular. – Ex.: *Temporary suture in middle line of frontal bone.*

S. Limbosa – The articular surfaces are more or less bevelled, and one overlaps the other. – Ex.: *Fronto-parietal suture.*

Sutura Notha or False Suture – A mere apposition of rough surfaces. – The subvarieties are the:

S. Squamosa – Considerable overlapping of extensively bevelled surfaces. – Ex.: *Temporo-parietal suture.*

S. Harmonica – Apposition in the mesial line of two symmetrical & vertically cut surfaces. – Ex.: *Articulation between the two halves of the upper jaw.*

Schindylesis – A thin plate of bone is received into a cleft formed by the separation of the two plates of another bone. – Ex.: *Articulation of the rostrum of the sphenoid with the vomer.*

Gomphosis – The implantation of the teeth into the alveolar processes.

AMPHIARTHROSES — The bones are bound together *almost* immoveably by means of thick plates of fibro-cartilage extremely adherent to each bone, and by strong external ligaments. In some cases the articular surfaces are partly covered by a thin layer of cartilage, and are partly lined with synovial membrane. The one class of amphiarthroses resemble the synarthroses, the other class resemble the diarthroses.

DIARTHROSES — The bones are bound together by means of external ligaments lined with synovial membrane, and the articular surfaces are covered with cartilage. Plates or rings of fibro-cartilage are sometimes included within the articular cavity, which cavity they occasionally divide into two distinct parts. – The arthrodiæ having recently been subdivided by Cruveilhier into arthrodiæ proper, condyloid articulations, & articulations by reciprocal reception, the varieties of the diarthroses may now be enumerated as follows (in the order of decreasing variety & decreasing extent of the movements they admit) – :

Enarthroses – Globular head received into a cup-shaped cavity. Well defined capsular ligament. The movements are flexion, extension, adduction, abduction, circumduction, & rotation. – Ex: *Hip-joint.*

Articulations by Reciprocal Reception – Articular surfaces inversely convex in one direction & concave in the other. Capsular ligament less perfect & complete than in the enarthroses. The movements are flexion, extension, adduction, abduction, & circumduction; there is no of axial rotation. – Ex: *Articulation of the metacarpal bone of the thumb with the trapezium.*

Condyloid Articulations – Ovoid articular head, or condyle, received into an elliptical cavity. Strong anterior, posterior & lateral ligaments. Flexion & extension very free; adduction, abduction & circumduction, rather less so; no axial rotation. Ex: *Wrist-joint.*

Ginglymi – Trochlear surface on the one hand, cavity of reception to correspond, on the other. Strong lateral ligaments; anterior & posterior ligaments but slightly marked. Flexion & extension only. Ex: *Elbow-joint.*

Diarthroses Rotatorii – Pivot-like process turning in an osteo-fibrous ring, or osteo-fibrous ring rotating upon an axial process. Rotatory movements only. Ex: *Superior & inferior radio-ulnar articulations.*

Arthrodiæ Proper – Articular surfaces flat or nearly so. Thin & loose capsules. Only gliding movements, which movements are never very extensive. Ex: *Acromio-clavicular articulation.*

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